PUBLIC WORKS

Jan. 1961

CITY, COUNTY AND STATE

New Concepts in TRANSPORTATION for Metropolitan Areas page 69

Ohio River ROBOT MONITOR Checks Water Quality page 73

Flat Area Requires 17 LIFT STATIONS for Sewerage System page 81

Semi-Automatic WATER PLANT Uses One Man Per Shift page 88

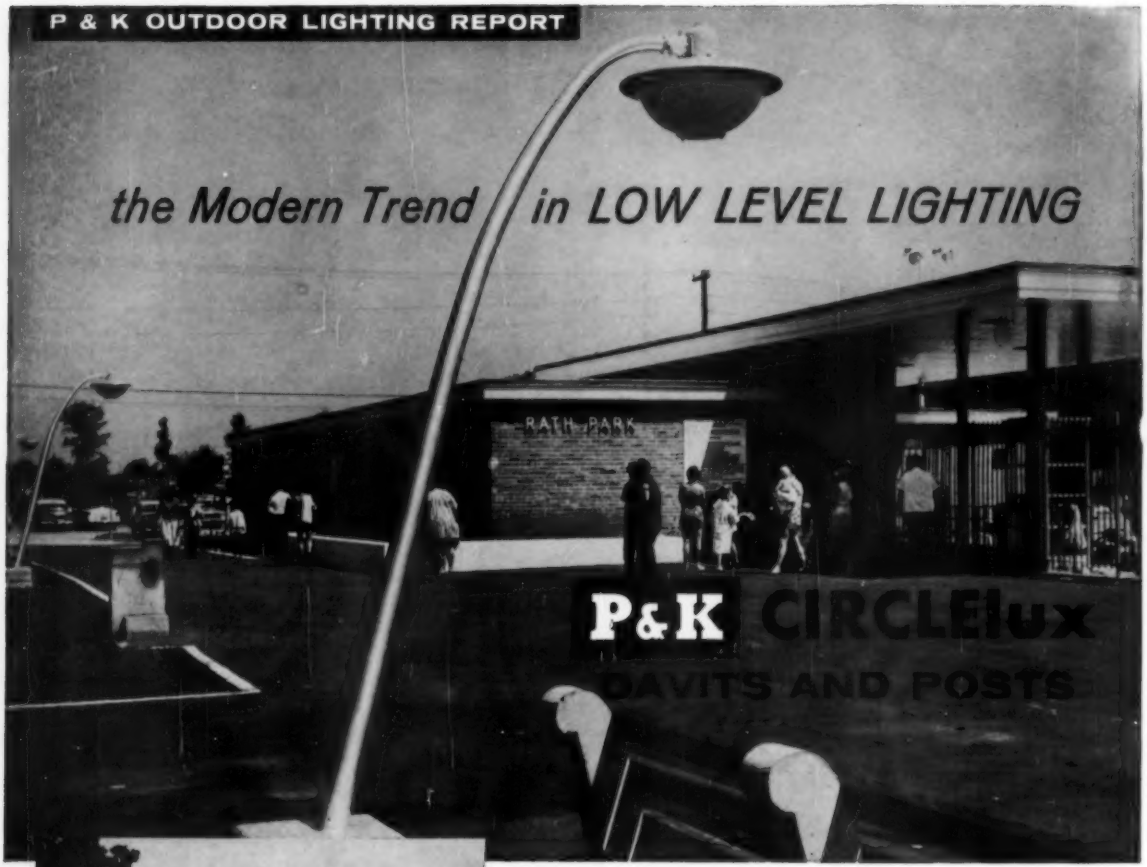
Modern Highway MAINTENANCE Equipment Developments page 95

SEE PAGE 5 for List of Articles in This Issue

Kenneth B. Woods, widely known as an educator, consultant and researcher, is Head of the Purdue School of Civil Engineering and is Director, Joint Highway Research Project. See page 18.

P & K OUTDOOR LIGHTING REPORT

the Modern Trend in LOW LEVEL LIGHTING



TOP PHOTO: Location: Rath Park, Franklin Square, L. I., N. Y.
Architect: Herbert D. Phillips
Consulting Engineers: Barstow, Mulligan & Vollmer

LOWER PHOTO: Location: Fairleigh Dickinson University, Madison, N. J.
Electrical Consultant: H. L. Sykes

modern lighting at a realistic cost

Here are two contemporary outdoor lighting installations – one an all new municipal swimming pool and recreational area – the other, a prominent New Jersey University. Both chose the P&K all aluminum CIRCLElux lighting package to illuminate and compliment their roadways, walkways, landscape and architecture.

The sweeping lines of the P&K CIRCLElux davit blend with the modern one story architecture of the Rath Park Swimming Pool. Yet, the modern, but stately, design of the P&K CIRCLElux post is in good taste with the traditional architecture of Fairleigh Dickinson University. The CIRCLElux lighting package is the correct low level lighting choice to compliment almost all types of architecture.

The P&K CIRCLElux is available in a wide range of davit styles and mounting heights. The post is available in one basic design but at various mounting heights and with the CIRCLElux you have a choice of three light sources – incandescent, mercury vapor and fluorescent. This combination of luminaires and davits or posts will enable you to specify "packaged" lighting units. This means easier specifying by using matched components which in turn can customize your lighting projects.

Send in your reservation now for the *new* CIRCLElux catalog.

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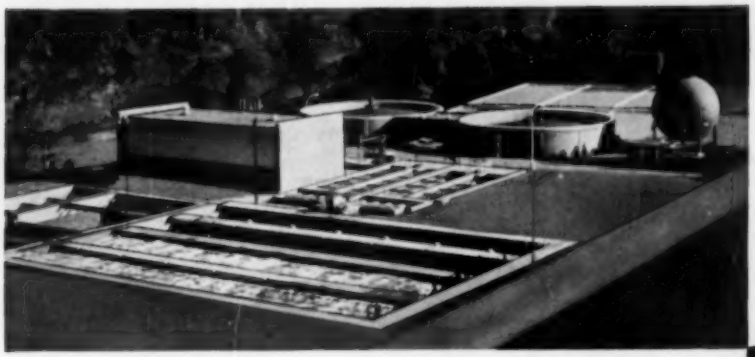
SAFER, MORE EFFECTIVE MUNICIPAL SEWAGE TREATMENT

"from Chicago"

Pleasant Hills Authority, Pennsylvania



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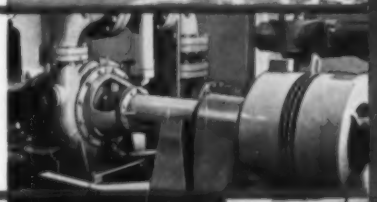
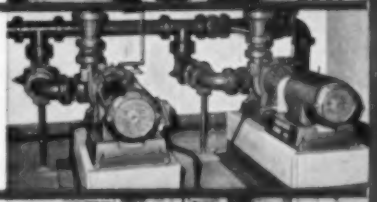


SP-5 Pumps for High Head, Heavy Duty Raw Sewage Pumping

Aer-Degritter Grit Removal System for Controlled Washing, Transporting and Concentrating Grit



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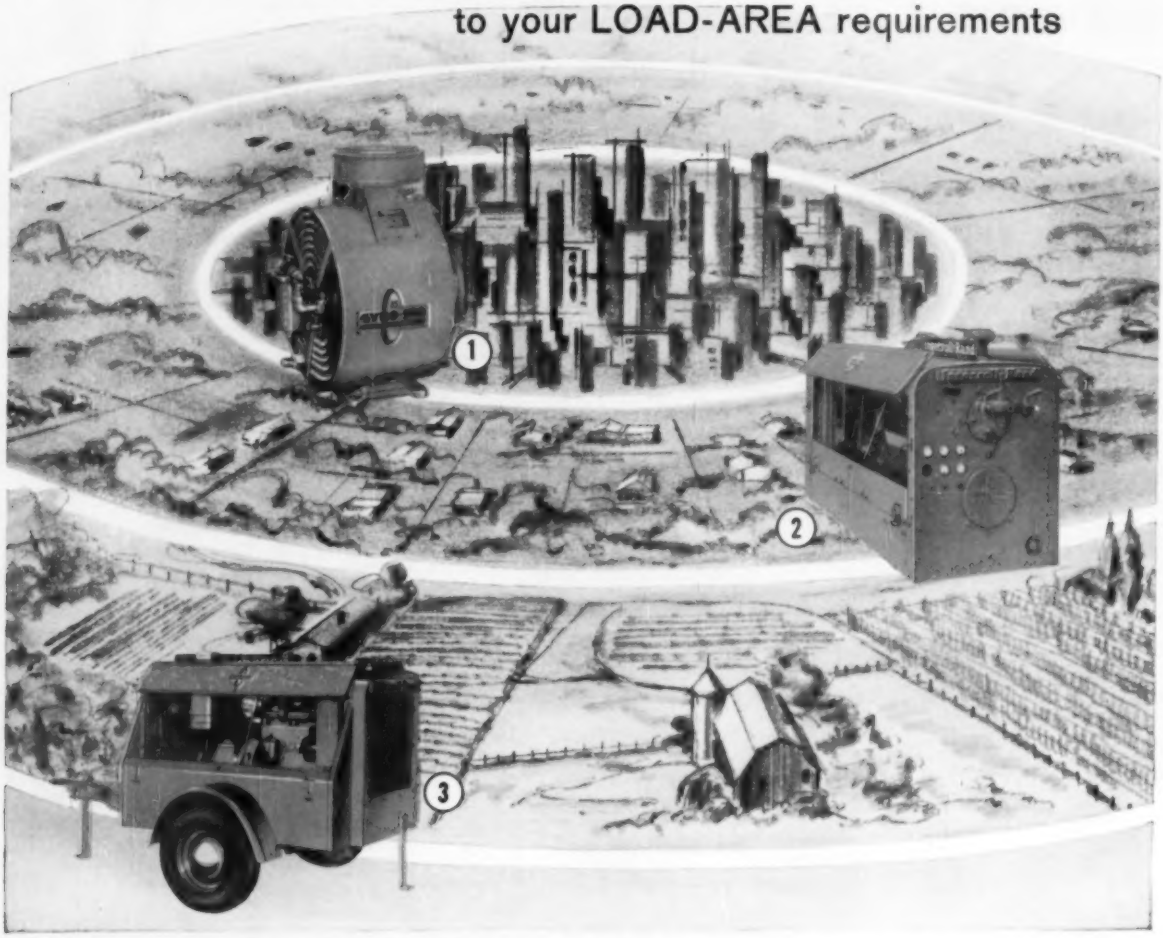

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PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATE

JANUARY, 1961 • Volume 92, Number 1

What Is the Future of Metropolitan Transportation? 69
New concepts, designed to serve the maximum number of people in the minimum amount of space, offer promising solutions to urban traffic congestion. ..... E. H. HARLOW

Robot Monitor Keeps Watch on River Conditions 73
Introducing the electronic sentinel developed by the Ohio River Valley Water Sanitation Commission to help safeguard streams from pollution.
E. J. CLEARY AND W. L. KLEIN

Traffic Committee Solves Intersection Problems 76
Experts in traffic engineering, street design and enforcement solve complex problems in Oakland,
WESTON E. FOLLETT

Sewer Inspection From An Easy Chair 78
Closed-circuit television looks into pipes to help maintenance crews. HAROLD S. RUDICH

A New Look at the Substance Water 79
Commonplace H_2O has many little-known qualities that give it glamor in the atomic age.
FRANK E. CLARKE

Sewer System Has 17 Lift Stations 81
New system designed to serve a large, flat area utilizes fourteen factory-built lift stations.
CLAUDE LESSIG AND F. LEE ROSS

New Compactor Replaces Two Open Trucks and Halves Collection Costs 85
Use of three men instead of six means big savings for this community. FRANK FORCE

Schoolhouse on Wheels for Equipment Operators 86
Training program gives California's highway division a skilled and reliable force of equipment operators. FRANK E. BAXTER

Treatment Plant Provides Iron Removal and Softening 88
Complex instrumentation of this semi-automatic plant reduces operators to one man per shift.
R. E. PETERS AND KENNETH W. COSENS

Developments in Highway Maintenance Equipment 95
Changes in equipment used by Illinois reflect modern highway building programs. J. E. BELL

Ground Fault Locator Protects Airport Ligh's 97
System reveals breaks in lighting circuits and locates point of failure without digging.

Fitting the Highway Into the Urban Plan 98
Through its influence on the community, highway planning becomes urban planning. Hence state and local cooperation is a basic requirement.
ELLIS L. ARMSTRONG

Snow Removal Contracts and Heated Pavements Aid Boston's Winter 103
Effective use of city forces and qualified contractors combat the unpredictable New England winter. TIMOTHY J. O'LEARY

First Zimmerman Process Plant Nearing Completion 105
Wet oxidation process for sludge disposal will be used at a Chicago treatment Plant.

Surface Drainage Problems Caused By Urban Development 118
DONALD W. TUCKER

Township Upgrades Equipment Spread 138
Quality instead of price was used to determine the "best bid" for this township.

Small Air Terminal Blends Economy with Eye Appeal 139

Storm Water Detention In Urban Areas 146
EUGENE J. DAILY

Unique Controls For Variable Speed Pumps 147

PUBLIC WORKS DIGESTS:

Highways and Airports 112
Sewerage and Refuse 122
Water Works 132
Industrial Wastes 142

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DEPARTMENTS AND SECTIONS

The Editor's Page 7
Leader in Public Works .. 18
Books in Brief 24
Reviews of Catalogs 30
Ed Cleary Says 54
Legal Notes 62
APWA News Bulletins 107
Municipal Power 148
Films in Brief 151
Letters to the Editor 154
New Equipment 158
News of Engineers 165
Worth Seeing 167
Worth Telling 168

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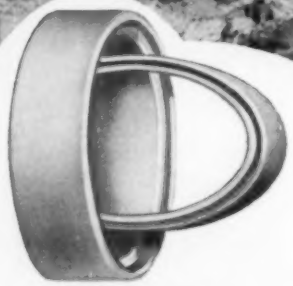

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THE EDITOR'S POINT OF VIEW

Accounting for Sewage Works

MANY FACTORS in the waste collection and disposal field are working to change the old picture that such facilities represent a necessary governmental installation where accounting is unnecessary; and the only financial records needed are bond and interest payments and the annual budget for operations. Now increasing numbers of sewerage systems and treatment plants, including package plants, are being built under private or corporation ownership. This fact imposes the necessity for accounting procedures and such questions arise as the useful life and permissible depreciation of sewers, manholes and other appurtenances; or treatment plant units, such as comminutors, pumps, chlorinators, sludge collection equipment, aeration devices and distributors; and of the concrete work in which these are installed. Also required is a sound basis for maintenance procedures and a definition of the distinctions between maintenance and betterment.

Little has been published on these problems. We invite our readers who have studied the subject to contribute of their knowledge and experience for the benefit of others who are, or soon will be, faced with this problem.

A Couple of Ho Hums

HAVING BEEN privileged to warm the boards of many hard conference-room seats at engineering meetings, two questions often come to our wandering thoughts. Why are the seats so hard and why are the papers so dry? If this sounds like unfair criticism to you then we've been on different conference circuits.

There is no denying that engineering conferences are a desirable and valuable professional function. Nor is there any question that the participants have worked industriously and capably to bring before the conferees, papers of real professional worth. But there is a valid question as to whether or not the true benefits of the conference opportunity are being realized through the impersonal and sometimes inaudible reading of a formal paper by the author. If the subject matter is of any depth, we will want to get a copy of the paper to read and study in the comparative quiet of our own office anyway. What we want most at the conference is an opportunity to know the man, to hear his own candid appraisal of the problem or project, to sense his concerns and his convictions and to bring back, along with the written facts, the added wealth of another professional personality with whom we have shared a few pleasant minutes unhampered by the restraint of the written word—which restraint we currently feel in trying to share this thought with you.

Good Housekeeping Is Still Needed

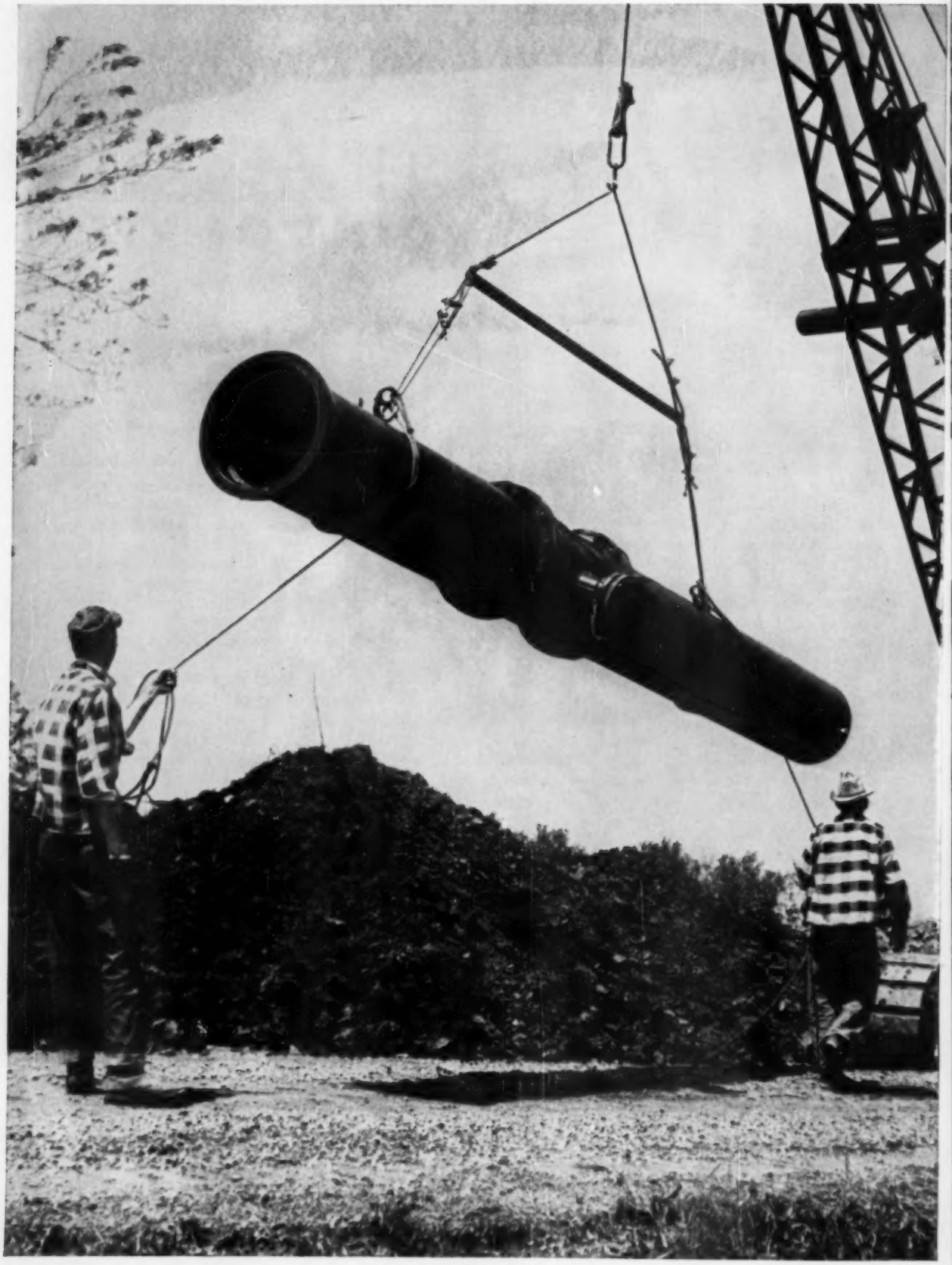
ONCE UPON a time a good many of us thought that such miracle compounds as DDT would eliminate all undesirable insects; and perhaps rats, too, would be no problem with the development of certain new poisons. Looking forward to developments in other fields, there seemed to be promise also that we no longer had to work so hard to treat sewage and industrial wastes, to dispose of garbage and refuse and even to maintain our streets.

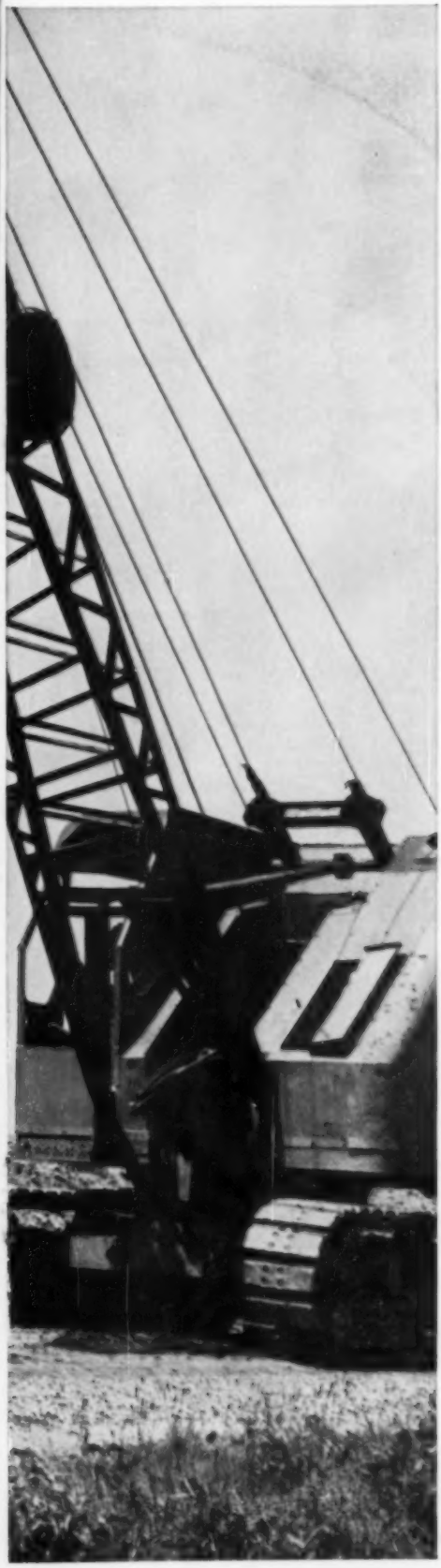
In the fifteen or twenty years since these dreams and visions were with us, we have found that there is no substitute for basic good housekeeping which is, after all, mostly well directed hard work. We can, however, use modern tools, materials and methods to make this hard work more effective and less costly. The problem thus becomes a two-pronged one—to organize and train our personnel to the proper procedures and to maintain an unremitting search for better equipment and materials; and having found them not to rest until they have been put to most effective use.

Six Inches of Road

ONE OF our overseas contemporaries reports rather sarcastically, that his country is providing 6 inches of road for each new motor car registration. We presume he means paved surface because total road mileage does not increase materially in any well-developed country.

In this country the average annual increase in motor vehicle registration over the past four years has been 1,930,000 units. At 6 inches per car, this would amount to something like 190 miles of new surfacing; and we are doing a lot better than that. There may be some doubt, however, if our new pavement construction, annually, is large enough to provide maneuver space for 1,930,000 cars, each averaging 18 ft. long. At any rate if any of you tried traveling during the holidays, you will agree we are not overbuilding.





PIPE THAT SHOULDERS A HEAVY LOAD WITHOUT SHOWING ITS AGE

Recently installed in a town in Illinois, this cast iron pipe water supply system now serves a large industrial area.

Besides the internal pressure of supplying the heavy daily demand, there is a heavy load overhead, too. The industrial area is a packaging and distribution center. Large numbers of fully loaded rail cars and trucks come and go every day.

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And it always delivers a full flow of water.

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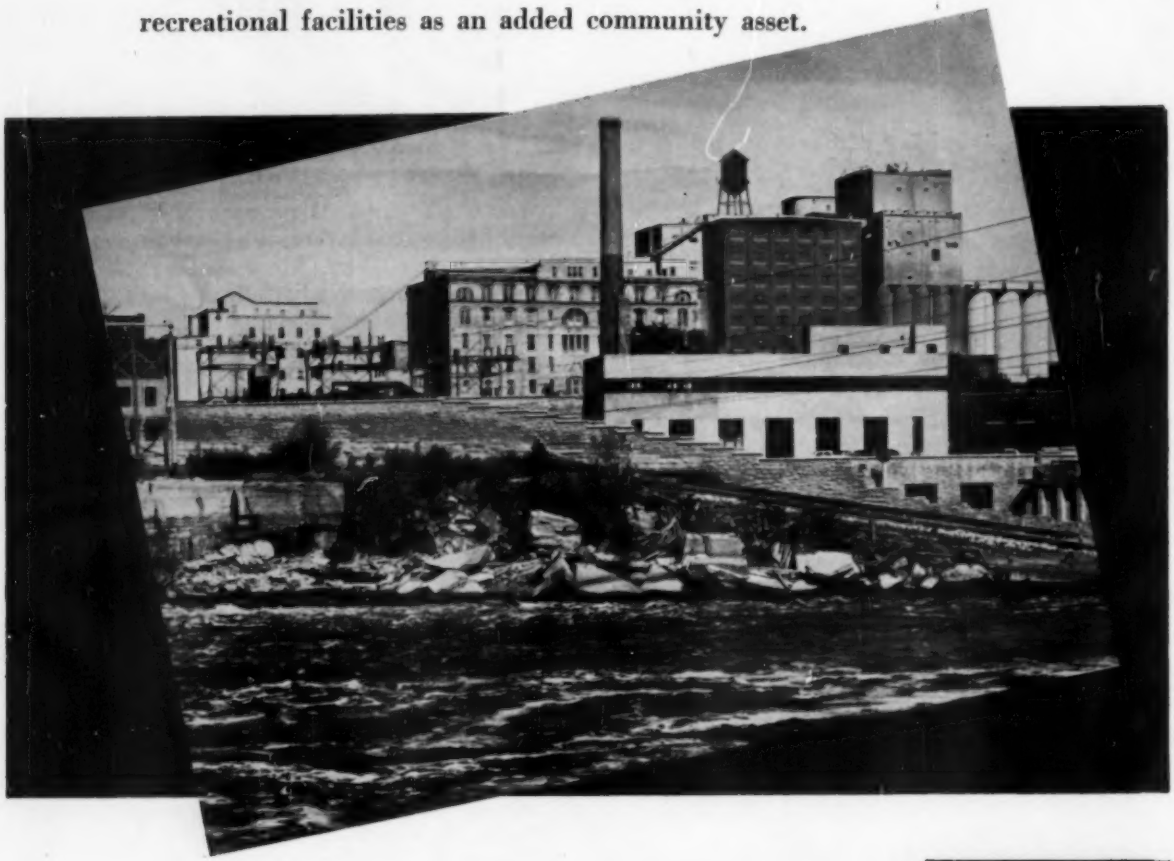

The best way to get clean waters

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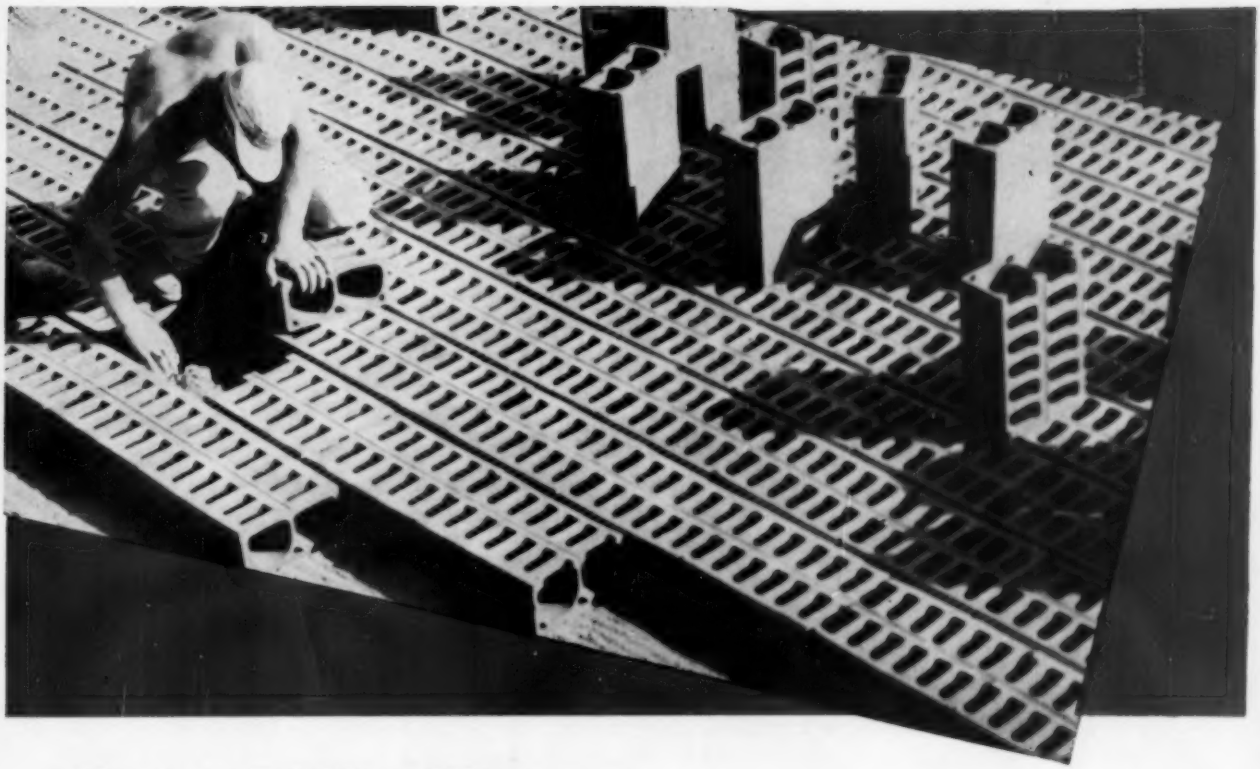
Treat your domestic and industrial wastes in modern sewage works with trickling filters. For economy and efficiency of operation and ease of future expansion these filters have no equals. Many of them built 30 and more years ago are performing as well today as when first constructed.



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TFFI clay block makers alone offer a 50 Year Guarantee for blocks made in modern plants under controls of quality so rigid that no substitute can even approach them in long, reliable life.

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Vitrified clay block manufactured by TFFI members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T. For a copy of these Specifications, see your TFFI Handbook or write nearest member for one.

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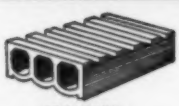

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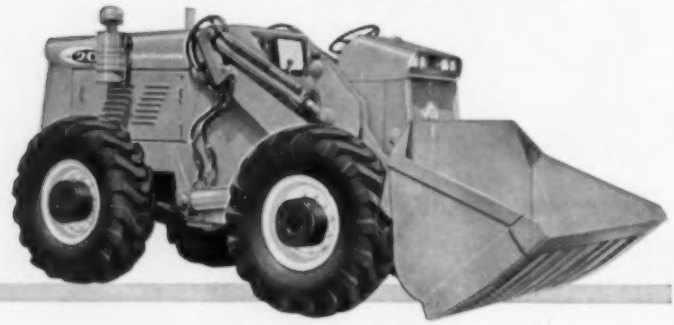
Now available in Persian Orange or Allis-Chalmers Yellow at no extra cost.



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20

Save on construction costs with the new '61 FORD TRUCKS

SAVE FROM $52 TO $221 ON PRICE* ALONE WITH FORD'S ECONOLINE PICKUP

Profit-conscious contractors are finding it's good business to do business with the new Ford Econoline Pickup. It's America's lowest-priced* pickup—bar none! Priced from $52 to $221 below other cab-forward economy pickups. But that's just the beginning! You get lively performance and proven gas economy with the popular Falcon Six. This modern engine goes 4,000 miles between oil changes, and has an aluminized muffler which lasts up to three times as long as ordinary mufflers.

And you can save more because Ford's functional design has pared away 1,000 pounds of dead weight, yet you still get the payload capacity of standard ½-tonners. The big 7-foot box provides a whopping 73 cubic feet of loadspace . . . that's up to 23% more than conventional 6½-foot pickups. A full 49-inch tailgate opening means you can load items like standard sheets of 4′ by 8′ plywood. And the full-length *flat* floor permits bulky or heavy loads to be positioned easily by sliding them anywhere in the pickup box.

And you can save on maintenance expense, too. The large engine cover can be lifted quickly, exposing the entire engine for rapid service. Spark plugs, distributor, etc., are conveniently located to speed engine tune-ups. And many major repairs can be made without ever removing the engine. One-piece cab-and-body construction provides increased rigidity and eliminates a major source of rust. In addition, all main underbody structural members are heavily zinc-coated to resist rust and corrosion.

**Based on a comparison of latest available manufacturers' suggested retail delivered prices*

SAVE UP TO $150 ON FRONT TIRES! In certified tests of truck suspensions, Ford front tires lasted up to twice as long. In 50,000 miles savings can add up to $150 on a pickup . . . more on two-tonners. And Ford's sturdy I-Beam front axle and leaf-spring suspension not only cut tire wear, but their simpler design also cuts maintenance costs.

12,000 MILE OR 12 MONTH WARRANTY

SAVE WITH GREATER DURABILITY . . . on all 1961 Ford Trucks, each part, except tires and tubes, is now warranted by your dealer against defects in material and workmanship for 12 months or 12,000 miles, whichever occurs first. The warranty does not apply, of course, to normal maintenance service and to the replacement in normal maintenance of parts such as filters, spark plugs and ignition points. Never before have you had such protection . . . such evidence of long-term economy!

SAVE WITH FORD'S NEW 262-CU. IN. "BIG SIX" ALL-TRUCK ENGINE FOR TOP PERFORMANCE AND ECONOMY

America's lowest-priced* medium-duty tilt-cab models now offer a big 262-cubic-inch Six with the power of big displacement, the gas economy of 6-cylinder design, plus the durability of heavy-duty construction. This engine features a sturdy stress-relieved head and block, strong forged steel crankshaft, long-lasting stellite-faced intake and exhaust valves and durable pyramid-type connecting rods. Positive Crankcase Ventilation reduces oil dilution and sludge formation to extend engine life. Ford's proven 292 V-8 and 292 HD V-8—the V-8's with "six-like" economy—are also available for your special power needs.

The popular Ford Tilt Cab Series outsells all other makes and for good reason! Their compact 82-inch BBC permits longer bodies within a given over-all length . . . for longer loads of lumber and building materials with excellent maneuverability. And set-back front axle design means more weight is carried on the front axle for greater payloads.

You also save with other new features like the stronger radiator with new lock-seam construction, and color-coded printed instrument panel electrical circuits that provide for greater reliability and simplified maintenance. In addition, Ford's parallel ladder-type frame, with standard 34-inch width, allows you to install new or transfer your present special construction bodies quicker and for less.

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YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" PROVES IT FOR SURE...

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at LYNCHBURG since 1828	132 YEARS
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at RICHMOND since 1831	129 YEARS
at BALTIMORE since 1834	126 YEARS
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at READING since 1834	126 YEARS
at HUNTSVILLE since 1836	124 YEARS
at LANCASTER since 1836	124 YEARS

If you want more proof, we can supply it. Sixty-eight cities are still using Cast Iron Pipe more than 100 years old. Join the Century Club! Safeguard your city's welfare with the only pipe that has stood the test of time.

This advertisement is published in the interests of the Cast Iron Pressure Pipe Industry by .....

WOODWARD IRON COMPANY

Since 1882

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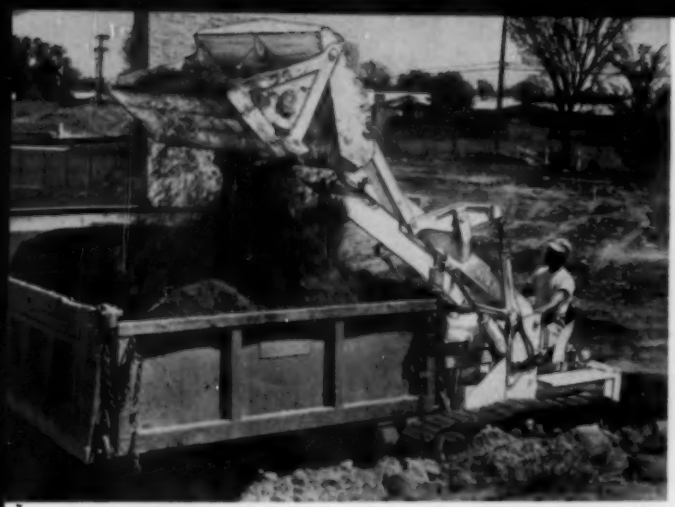

Gain an extra 1½ ft of dumping height by dumping through the bottom of the bucket. Bottom dump feature also enables the operator to control the rate of flow while spreading materials such as gravel, crushed stone or top soil.

Fine-grade with almost motor grader accuracy using scraper action. Exclusive Skid-Shoes on the bottom of the bucket help hold to grade. Your operator can even let go of the controls and still maintain precision accuracy . . . speed up work.

3/4-yard clam action Four-in-One

expands limited equipment budgets!

For just a little more than the price of a conventional ¾-yard tractor loader you can have a "fleet" of equipment! Only the International® Drott T-340 Four-in-One gives you the actions of bucket, bulldozer, scraper, and clamshell, *all* in one machine.

Working alone, one operator with a T-340 Four-in-One can handle a variety of jobs which formerly required a crew with two or three specialized pieces of equipment. Just think of the time and money-saving convenience of such a machine . . . imagine how it would stretch your new equipment and operating budgets. With a Four-in-One, jobs would be completed *right now,* instead of waiting for various pieces of equipment to become available.

You can count on dependable performance, too. T-340 and TD-340 crawlers are IH-tough, with International's traditional built-in stamina. Fuel costs are among the lowest for crawlers in the under 50 hp class.

Find out first hand the many ways the T-340 can expand limited equipment budgets. Ask your nearby IH dealer for a demonstration soon.

International Harvester Co., Chicago 1, Illinois

Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL DROTT

Back drag with the front half of the bucket to dress banks or clean out ditches. Tractor remains on firm ground. Alternate equipment needed for doing the same jobs would cost far more.

Raise the front half of the bucket all the way and you have an efficient bulldozer. Skid-Shoes hold the blade to grade accurately . . . there's no sudden "suck in" of the blade.

"Call FOSTER... get Line Pipe PLUS"

When you need large diameter pipe, especially 12¾" thru 48", L. B. Foster Co. can supply all you need from any one of its seven nationwide warehouses. And where's the "plus"? It's the "Faster From Foster" service that speeds your order.

As one of the country's major pipe specialists, Foster offers a one stop source to water works engineers and superintendents for municipal and industrial line pipe. This includes bare pipe and "controlled-quality" coating and wrapping—or lining—up to 78" diameters, and to all standard specifications.

Also, check Foster for savings on Structural Grade pipe—ideal for non-pressure use, and for water well casing and pump columns.

Write **L. B. FOSTER CO.** for Stock List PW-1. Pittsburgh 30, New York 7, Chicago 4, Houston 2, Los Angeles 5, Atlanta 8, Cleveland 35.

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Pipe • Valves • Fittings • Piling • Rail

Kenneth B. Woods has been Head of the School of Civil Engineering and Director of the Joint Highway Research Project at Purdue University, Lafayette, Indiana, since 1954. He is widely known for his work in research and as a consultant on the location, design and construction of air fields, railroads, and highways in Alaska, Canada and the United States.

A native of Sunnyside, Washington, Prof. Woods received his BCE from The Ohio State University in 1932 and the Professional Degree of Civil Engineer in 1937. In 1949 he received the Distinguished Service Award of the Highway Research Board. He was elected Chairman of the Board's Executive Committee in 1956 and the same year was named Chairman of the Advisory Committee of the American Association of State Highway Officials for the $21,000,000 road test program at Ottawa, Illinois.

Prof. Woods has a long record of active service in the American Society for Testing Materials, including work on many committees as well as election as a Director of the Society in 1953, Vice-President in 1956 and President in 1959.

Memberships in other societies include American Society of Civil Engineers, The Association of Asphalt Paving Technologists, American Road Builders' Association, American Concrete Institute, The Society of American Military Engineers, The American Society for Engineering Education, U. S. Council on Soil Mechanics and Foundation Engineering and others.

He is a consultant on permafrost and arctic construction in Alaska, Canada, and Arctic Islands, and has also been engaged in the Middle East on site selection, soil mechanics and materials of construction.

Professor and Mrs. Woods make their home in West Lafayette, with three sons and two grandchildren living nearby. His hobbies include color photography, travel, engineering geology, the Civil War and the American Revolution.

NOW THE FIRST

MAGNETIC DRIVE METER WITH A DISC METER CHAMBER

THE Badger *Easy-Read**

GIVES NEW POWER TO A TIME-PROVEN PRINCIPLE

Here is performance unmatched by any other meter on the market. Only the Badger Easy-Read combines time-proven disc meter accuracy and dependability with the efficiency of magnetic drive.

The benefits of this new type meter are many, beginning with the elimination of the troublesome stuffing box and consequent drag and leaks.

Still more top features: a low-friction, self-cleaning sapphire jewel bearing, located in the water chamber, carries the thrust of the magnetic coupling . . . a tamperproof sealed register . . . a new, exclusive removable register . . . the most readable register face of any meter yet marketed.

And most important: Easy-Read's full-size disc and chamber provide interchangeability with standard Badger disc meters. You can modernize the Badger meters now on your system with a new housing top and register-gear train assembly.

Whether you convert your present system or install a new one — Badger Easy-Read means more economical operation, easier serviceability and dependable performance.

Ask your Badger representative now to give you complete details on the new Easy-Read meter.

THE POSITIVE DRIVE OF PERMANENT MAGNETS

Each of the magnets that form the magnetic coupling consists of a non-corroding ceramic ring. They have the most desirable combination of magnetic properties and corrosion resistance available today. Intensive tests prove they are permanently magnetized.

Badger's magnets are also larger, giving greater power in the coupling to drive the register — power so strong it can drive *every* register or meter-driven accessory.

*Patent applied for

POWER THAT'S SEALED TIGHT

against leaks and tampering

against fogging, water and mud

Stronger magnets assure more positive drive

As water flows through the meter chamber, a full-size disc turns the lower drive assembly. The entire assembly, including the four-pole ceramic ring magnet, is suspended in a dual bearing system.

Badger's stronger magnets transmit power through the cast bronze wall separating measuring and register units. Four poles lock to provide positive drive.

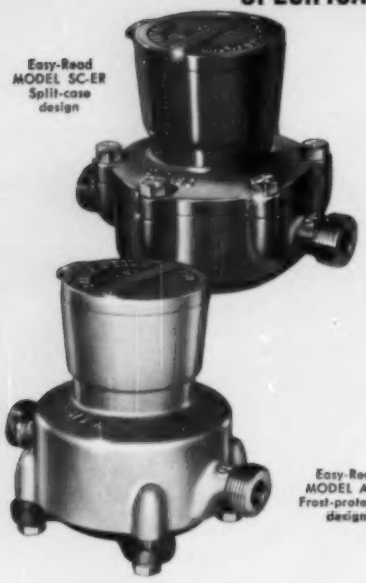
A—Sapphire jewel bearing. **B**—Driven magnet. **C**—Drive magnet. **D**—Disc. **E**—Radial bushing. **F**—Sealed register and gear train assembly.

THESE ARE *Easy-Read* exclusives:

SOLID DRIVE SHAFT—Pigtail drive shaft is permanent, welded integral with wheel. Each number wheel extends totalizer capacity of ½" meter to [illegible]

REMOVABLE REGISTER is mounted by bayonet lock attachment. It's the only sealed, magnetic driven register that can be removed, even under water, without disturbing the meter in the line. Register and cover can be mounted in any of four positions for easier readings.

SPECIFICATIONS



Easy-Read MODEL SC-ER Split-case design

Easy-Read MODEL A-ER Frost-protective design

Meter Size Inches	Net Weight Lbs.	Length Inches	Width Inches	Height Inches	Port Holes Center to Base	Length Coupling Inches	Safe Operating Capacity G.P.M.
MODEL SC-ER							
⅝	10⅜	7½	5½	6¼	1⅞	2⅜	20
⅝ x ¾	10½	7½	5½	6¼	1⅞	2½	20
MODEL A-ER							
⅝	10⅝	7½	5½	6⅜	1⅞	2⅜	20
⅝ x ¾	10¾	7½	5½	6⅜	1⅞	2½	20

ANOTHER IN BADGER'S BIG PARADE OF NEW PRODUCTS FOR BETTER WATER METERING

Twice within a year, Badger has introduced pace-setting products to the water meter field. The Read-o-Matic®, the industry's first practical outdoor meter-register, and the powerful new Badger Easy-Read — to help water departments everywhere steadily increase operating efficiency and lower costs.

These products were developed after years of research and torture-testing. Work on a magnetic meter began in 1934. Badger's first magnetic drive meter was placed in service in 1940 (see inset photo).

These "pioneer" meters led to the development of the new Easy-Read and its superior, permanent magnets.

New products are part of Badger's program to better serve the water works industry. For information on any of our meter products, see your Badger representative or write direct to Badger Meter Manufacturing Company.

Badger Water Meters

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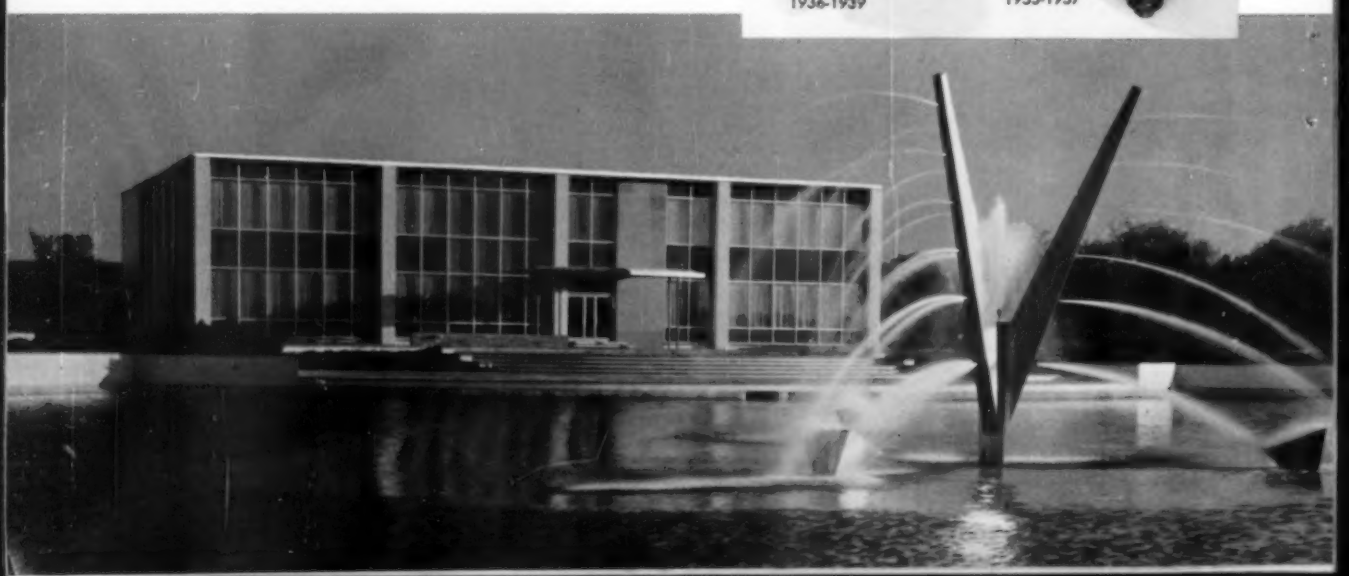
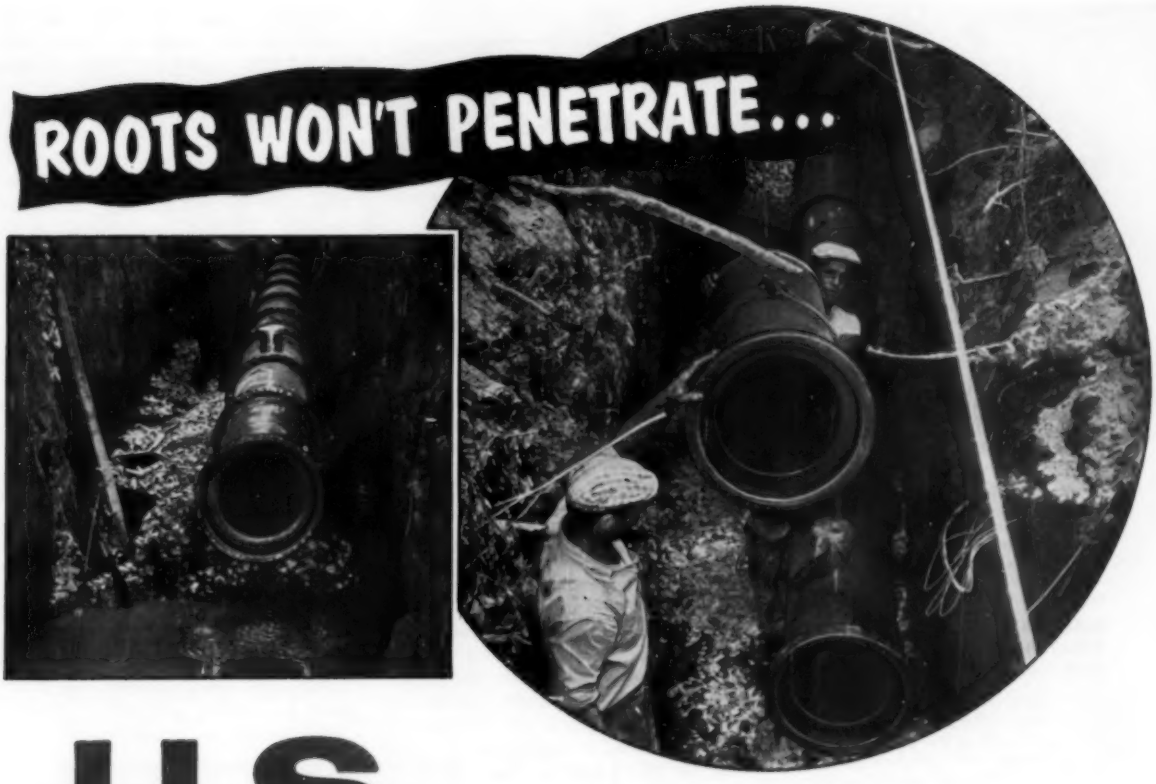
Dallas 35, Texas — Seattle 4, Washington
Los Angeles (Compton), California — Long Island City 1, New York
Atlanta 18, Georgia — Milwaukee 23, Wisconsin
Cleveland 35, Ohio
BRANCH OFFICES in principal cities



ROOTS WON'T PENETRATE...



U.S.

Flexible-Coupled VITRIFIED CLAY PIPE

OWNER: Ewing-Lawrence Sewage Authority, William Higgins, Manager, Trenton, N. J.

ENGINEER: Buck, Seifert & Jost, Consultants, New York, N. Y.

CONTRACTOR: H. W. Alward, Bernardsville, N. J.

PIPE: 12", 15" and 24" U. S. Vitrified Clay Pipe with pre-assembled TYLOX Rubber Gaskets.

Why run the risk of an entire pipe line becoming inoperative due to root penetration at a few leaky joints? U. S. Vitrified Clay Pipe with built-in compression-sealing Gaskets offers the greatest measure of protection against this costly problem by assuring water-tight couplings at *all* joints.

Gaskets are precision-made from rubber, neoprene or P.V.C., pre-assembled to pipe at the factory, and the pipe shipped ready for immediate installation. It takes only a few seconds to couple each length into the line, and the compression seal is made automatically.

Engineers and contractors use U. S. Flexible-Coupled Vitrified Clay Pipe, not only to assure tight joints, but to take advantage of two other important features . . . *faster-coupling* reduces installation costs, and *acid immunity* of both Pipe and Coupling assures pipe lines that can be relied upon for many generations of trouble-free service. Contact us to arrange for U. S. Flexible-Coupled Vitrified Clay Pipe on *your* next project.

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BIOLOGICAL PROBLEMS IN WATER POLLUTION

This volume represents the "transactions of the second seminar on biological problems in water pollution" held in April, 1959, at Cincinnati under sponsorship of the Robert A. Taft Sanitary Engineering Center. It was compiled by C. M. Tarzwell, Chief of Aquatic Biology and is dedicated to pioneers in the field—William C. Purdy and C. T. Butterfield.

The text, which contains 285 pages, is divided into subjects under which the numerous papers are grouped. These are: Effects of the discharge of radioactive materials on aquatic life, 6 papers; effects of pesticides on aquatic life, 11 papers; environmental requirements for aquatic life, 4 papers; application of biological findings in pollution abatement, 6 papers; marine and estuarine pollution problems, 8 papers; informal group discussions, 19 papers; oil refinery waste problems, 2 papers. No information is available as to procedures for obtaining copies, but a letter may be sent to the Division of Water Supply and Pollution Control, R. A. Taft Sanitary Engineering Center, Cincinnati 26, Ohio, asking for information on Technical Report W60-3.

212 PAGES ON WATER CONTROL EQUIPMENT

That's the briefest possible description of a new technical catalog, over two years in preparation, which has just been announced covering design data and specifications for sluice gates, regulators, valves, rakes, racks, screens—all that enters into large scale water control. For your free copy write, on your letterhead, to Rodney Hunt Machine Co., Orange, Mass.

PAVEMENT SERVICEABILITY PERFORMANCE CONCEPT

In one of the papers in this bulletin a panel of highway users rated personally the serviceability of various sections of pavement. The users included federal and state highway engineers, truckers and material producers. They were driven over 138 different sections of highway and were asked to rate these on the basis of "how well would this road serve me if I were to drive my own car over roads just like it all day long?" The evaluation was then compared to objective surface measurements. Two other papers are included in this Bulletin 250. Highway Research Board, 2101 Constitution Ave., Washington 25, D. C. 58 pages; $1.40

CIVIL DEFENSE FALLOUT SHELTERS

A technical manual, Fallout Shelter Guide for Architects and Engineers, is available from the Office of Civil and Defense Mobilization, Washington 25, D. C. This is appendix 2, annex 10, National Shelter Plan. It is well illustrated and, in its 52 pages, it covers: Shielding fundamentals; shielding calculations; space and ventilation; water supply and sanitation; power supply and other factors; and community survey procedures. Also available is Publication MP-15, 32 pages, illustrated, which covers the family fallout shelter, providing detailed information on construction.

PLAYGROUNDS: THEIR OPERATION & ADMINISTRATION

This is a third edition, completely revised and newly illustrated, of a standard guide to playground administration and operation. It covers all topics that can contribute to improved planning and administration of playground programs. There are 25 sections covering layout and equipment; care and maintenance; recruitment and selection of workers and the training of personnel; organizing activities; rules for personnel and for facility use; public relations; safety and health; special problems; and bibliography. There are 479 pages with 47 illustrations. George D. Butler, Director of Research and Assistant Executive Director, National Recreation Assn. Published by Ronald Press, 15 East 26th St., New York 10. Price $7.

STANDARDS OF THE HYDRAULIC INSTITUTE

The first revision, 10th edition, Standards of the Hydraulic Institute, copyright 1955, are available. These cover 75 pages on colored stock for insertion in the original loose-leaf cover. Numerous items are included in the revisions. These include clarifications in drawings, nomenclature and text; new definitions on flooded suction, specific speeds and self-priming pumps; new charts for centrifugal hot water pumps; revisions in the test code

ACID-RESISTANT, WATER-TIGHT, QUICK-COUPLING JOINTS

for straight and offset concrete sewer pipe

with TYLOX®

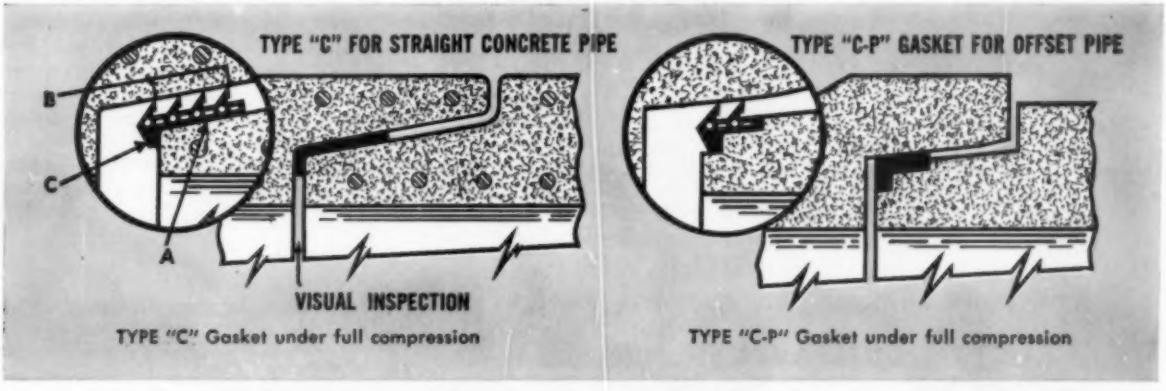
"C" SERIES

flexible GASKETS

Sanitary Engineers can take advantage of the matchless efficiency of TYLOX Flexible Gaskets for coupling *any* concrete pipe sewer they design . . . because there's a specially designed TYLOX cross-section for *any type* of concrete pipe!

Type "C" Gaskets for straight, and type "C-P" Gaskets for offset pipe, provide the same high performance features you are accustomed to in famous Type "A" Gaskets . . . PLUS a visual inspection feature made possible by a flange which overhangs the edge of the pipe tongue, or tongue offset, according to the type of pipe. On pipe large enough to admit workmen, proof of correct gasket positioning can be obtained by noting whether the inspection flange is evenly seated around the entire circumference of the joint. The larger the pipe, the more important this visual inspection feature becomes.

TYLOX "C" Series Gaskets are made for all pipe sizes, handle head pressures up to 50-feet, and are available in either rubber or neoprene. They may be applied to pipe at the pipe manufacturer's plant, or at the job site. Like all TYLOX Gaskets, they are immune to sewerage and industrial waste acids, and keep joints *water-tight* for the life of the pipe itself.



"C" Series TYLOX Gaskets consist of base A; sealing fins B; and inspection flange C. In addition to providing the inspection feature, the "locking" effect of the flange holds Gasket in true position as pipe is coupled. Design of the sealing fins is such that horizontal end-thrust forces causing "kickback" in some couplings, are eliminated in Tylox "C" Series Gaskets, assuring full seating and true alignment of pipe.

5147-3

WRITE FOR DATA BROCHURE

Fully illustrated literature contains engineering data and installation information. Get it for your files. See why there are more TYLOX Gaskets specified for low head service than all other types of gaskets combined. Specify TYLOX Flexible Gaskets for jointing your waste disposal pipe lines.

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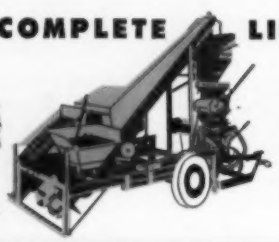

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for centrifugal pumps; and calculation of volumetric efficiency of reciprocating pumps, using compressibility factors for water and for hydrocarbons. The set of revisions costs $1.25; the full standards, revised, cost $6. Order from The Hydraulic Institute, 122 East 42nd St., New York 17, N.Y.

STEEL FOR MULTI-STORY BUILDINGS

A 48-page booklet with examples of 15 multi-story steel buildings. Typical floor plans are shown, percentage of rentable or usable space; square foot costs; some details; and much general data of interest. A very nice job by The American Institute of Steel Construction, 101 Park Ave., New York 17, N.Y.

MECHANICAL-ELECTRICAL EQUIPMENT FOR SCHOOLS

The schools of today involve a great deal of mechanical and electrical equipment, the cost of which is about 25 percent of the initial cost of the school. In addition to the necessity for protecting this investment, proper operation and timely maintenance are needed to assure continuous performance of the primary function of the school. This book tells how this big family of equipment should be installed and how it should be cared for and used. Major sections include heating and ventilating, plumbing, sewage disposal, kitchen and cafeteria equipment, lighting and wiring and reference material. Illustrated; 395 pages; $9.50. By Harry Terry; published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y.

HIGHWAY BRIDGES

Two Highway Research Board papers are included in the 27-page booklet. One is on bridge painting; the other is on getting smooth-riding bridge decks. Available from the Highway Research Board, 2101 Constitution Ave., Washington, D. C. for 60 cents.

ASPHALTIC CONCRETE CONSTRUCTION

There are three papers in this Bulletin 251. One describes the use of full-scale equipment in laboratory work; a second compares density of laboratory mixes with those of mixes in place after several months of traffic; a third reports on the compaction of hot asphaltic concrete using steel wheel rollers. 37 pages. Highway Research Board, 2101 Constitution Ave., Washington, D. C., $1.

First Operational Reports in!

New '61 Larks in actual fleet service save 10% • 14% • 16% • 25% over other fleet cars

What should you expect to gain when you put '61 Larks into your own fleet? Here is a certified report by the United States Testing Company, based on daily use of The Lark under normal operating conditions in four giant fleets:

All drivers were favorably impressed with the increased power and acceleration of the new Skybolt Six engine – the responsive, easy steering of the new steering/suspension complex – the excellent handling and maneuverability all through.

And the report makes specific cost comparisons with the most widely used fleet cars—Chevrolet, Ford, Plymouth, in comparable models. Here's what you save:

Initial cost **averages 14% less . . .** ***Insurance*** **(with Illinois as the basis) costs 10% less . . .** ***Registration and Taxes*** **(Illinois) are 16% less . . .** ***Tires*** **save approximately 15% . . .** ***Repairs and Replacements*** **(from MOTOR's 1960 Crash Book) average 25% less . . .** ***Gas Consumption*** **(based on 5,000 everyday drivers) was more than 15% better.**

These are unmatched advantages in economy. In fact, they top the savings on any other compact car as well. And they show you why each day's mail brings such Lark Fleet orders as 35 for a mid-western route sales operator, 566 for a western state, 134 for an eastern taxi fleet, 51 for one telephone company, 38 for a municipal Police force in the southwest.

THE '61 LARK BY STUDEBAKER

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GET THE FULL STORY ON FLEET SAVINGS!

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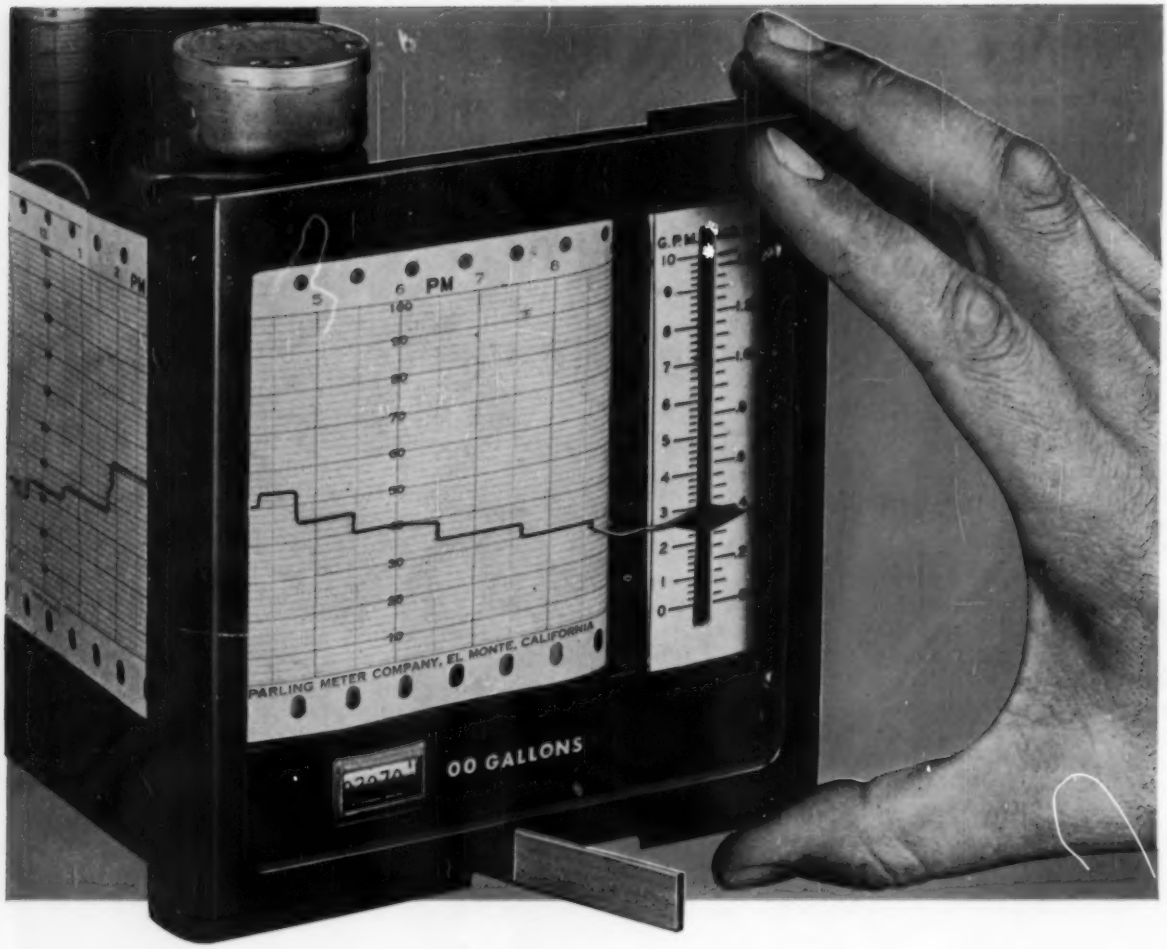
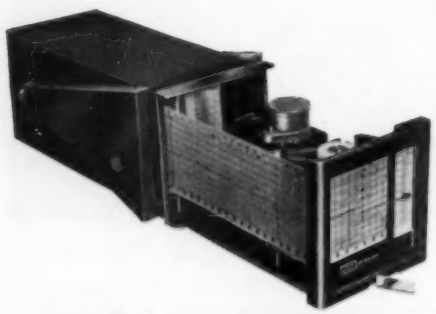


New SPARLING MINIATURE STRIP CHART INDICATOR • TOTALIZER • RECORDER



COMPLETE FLOW INFORMATION IN LESS THAN 1/4 PANEL SPACE

Indication, *totalization* and recording—the same as in full size instrumentation—are all provided in this new, compact unit. Uses standard components, yet requires little more than 6" square panel area. Has 6-digit totalizer, dual equivalent scales, and effective range of 20:1. 60 or 120 day records. When chassis is removed, 26 hours of records are visible without moving chart. Ideal for graphic or conventional panels, and standard electronic racks. WRITE FOR TECHNICAL BULLETIN CF-390.

Sparling equipment includes a complete line of instruments, controls and propeller meters for all main-line requirements.

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WATER CONTROL EQUIPMENT

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Sanitary landfill cost cut 25% with "Spot-Turn"

OLIVER OC-46

Here's the catalog that's required reading for budget-minded cities: the OC-4 bulletin. It's heavy on job-application pictures and data—shows the OC-46 tooled-up with work-speeding, cost-saving equipment attachments. Ask us for your copy.

Absecon, New Jersey, keeps a sharp eye on the cost of its sanitary landfill operation. That's why this town is happy it bought an OC-46 "Spot-Turn" loader. The facts prove that a 25% saving is realized using the OC-46 versus the former method of hiring an outside contractor.

"'Spot-Turn' is the feature that saves us time and money," says George Gillespie, city councilman in charge of Streets and Roads Dept. The close-quarter maneuverability with shortest turn-around radius of the OC-46, plus its higher measure of diesel power, makes quick work of compacting and covering refuse. And the time saved by the OC-46 lets Absecon put it to work loading trucks for street and road maintenance, thereby gaining further savings.

Why not see...try the OC-46 yourself. It's the compact, big-job tackler that's sized right for city and township work—and lowest in its class for price! Oliver Corporation, Chicago 6, Ill.

SEE YOUR

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DEALER

Turn to your dependable Oliver dealer when you need hurry-up service and genuine Oliver spare parts.

EQUIPMENT and MATERIALS FOR YOUR PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Permanent Cast Couplings for Long Life Pipe Lines

700. Is the title of a new 12-page booklet, full of facts, figures and pictures which emphasize the versatility of couplings which will also connect pipe having variations in outside diameter. Get your copy of booklet 216 from Smith Blair Inc., 535 Railroad Ave., South San Francisco, Calif., or circle number on this card.

Hang Up Your Blueprints

701. The space-saving way. Easier to find, better protected than with old-fashioned drawers. A new circular tells all of the advantages of this new way of doing things in the drafting room. For yours write for "GLIDER" folder, to Momar Industries, 4176 West Montrose Ave., Chicago 41, Ill., or circle our card-number.

New Data on Gate and Check Valves

702. New 16-page catalog clearly describes and illustrates A.W.W.A. valves in sizes 2" through 12" for all types of water main pipe. Made by 30-year old company. Ask for Catalog 60 from American Valve Mfg. Co., Manhasset, L. I., New York, or check our card.

The Complete Public Works Construction and Maintenance Machine

703. Is the apt title of a comprehensive folder on The Gradall which can be an eye-opener in describing its versatility in all public works construction and maintenance operations. Get the full picture by writing for "Population Explosion" folder to Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio, or check number on the card.

Lighting Standard Equipment

704. Included in these two catalogs, Octagonal Tapered Steel and Aluminum (No. 0-1-860) and Aluminum Round Tapered (R-1-10-60), are new designs in both street and area lighting standard equipment with a good variety of arms to meet most any lighting problem. Traffic Signal Standards and Brackets and Mast Arms for wood, metal pole and wall mounting are included in the Round Aluminum catalog. Write to Kerrigan Iron Works Company, Eleventh & Herman Street, Nashville 2, Tenn., or circle reply card.

Hydraulic Aerial Platform

706. Complete package unit including truck chassis, aerial platform and special utility body described in bulletin on this valuable equipment for globe cleaning and street lamp replacement programs. Circle reply card or write Ottawa Steel Division, Young Spring & Wire Corp., Ottawa, Kansas for bulletin.

Versatile Crawler With Power and Controlability

707. Within this 24 page booklet (Form No. 607R) are liberally illustrated descriptions of the features of the Euclid C-6 for clearing, dozing, stripping, grading and a variety of other applications. Specifications covered. Circle reply card or write to Euclid Division of General Motors Corporation, Cleveland 17, Ohio.

Admixtures for Concrete

705. . . . are described in this new folder covering uses for water reduction, increased durability and workability, decreased shrinkage and permeability. Specifications are also outlined. Circle reply card for copies of bulletin CA-6A or write to Johns-Manville, Cement Additives Unit, 22 E. 40th St., New York 16, N.Y.

Compact Rotary Snow Mover

708. Snowblast rotary snow plows, proven in heavy duty airport and highway work, are also available in compact, high-capacity models for parking lots, traffic congested streets, sidewalks and many other applications. For bulletin return reply card or write American Snowblast, 1237 Shoshone St., Denver 4, Colo.

Cationic Emulsified Asphalts

709. Every phase of application, from surface treatments to mixing operations, is covered in the booklet on this most promising development in the paving field. Check the reply card or write to American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Cal.

Mercury Vapor Lamp Manual

711. A comprehensive manual covering nearly all phases of mercury vapor lamps, the new 28-page technical booklet contains the latest information on nearly all phases of mercury lamps including light output, life ratings and electrical and physical characteristics. In addition, it describes lamp construction, designations, color rendition and necessary auxiliary equipment. The manual, called, "Mercury Lamps," may be obtained from local Westinghouse lamp sales offices or by returning the reply card.

Readers' Service Index

New Catalogs ....pages 30 & 32
Construction .....pages 32 & 34
Refuse .....page 32
Recreation .....page 34
Lighting & Traffic .....page 34
Snow & Ice .....page 36
Water Works .....pages 36 & 38
Sewerage & Waste pages 40 & 42
Street & Highways .....page 46
Odor Control .....page 46

Cut Costs for Ground Maintenance

712. . . . with the Gravely tractors and wide variety of attachments for snow plowing, salt & cinder spreading, mowing, cultivating and lawn care. Ask for bulletin from Gravely Tractors, Dunbar, West Virginia or circle the reply card.

Ample Air Power

713. . . . is available with Gyro-Flo compressors in PTO, truck-mounted or wheeled units. Oil-injection cooling and two-stage oil separation are two outstanding features described in booklet (Form 2938 9-FO) available from Ingersoll-Rand, 11 Broadway, New York 4, N. Y., or by returning the reply card.

Petroleum Products For Equipment

714. Descriptions and suggested applications for the company's complete line of diesel and gasoline motor oils, gear lubricants, transmission fluids, and greases. Booklet (A4254 9-60) available from Sun Oil Company, Industrial Products Department, 1608 Walnut Street, Philadelphia 3, Pennsylvania, or check our reply card.

Clarifier with an Integral Sludge Thickener

717. . . . permits doubling sludge solids concentration without use of a separate tank. The unit is basically a center-feed clarifier with a central thickening compartment at the bottom of the structure where settled sludge is held 12 to 24 hours to attain maximum density. Get Bulletin SM-1018 of descriptive and design data on the Clari-Thickener from the Eimco Corp., P. O. Box 300, Salt Lake City 4, Utah, or check the reply card.

100 HP Motor Grader

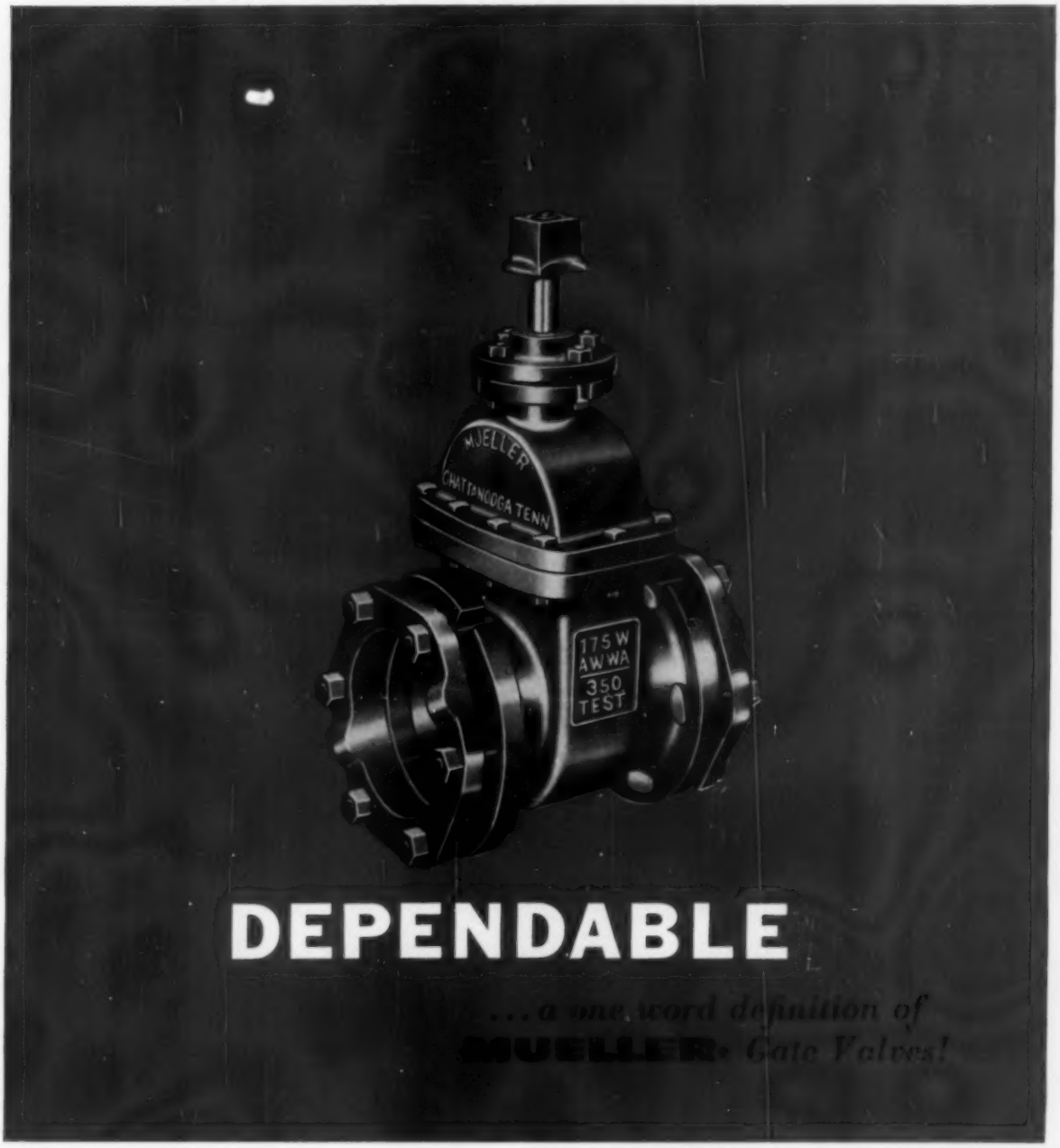
715. Model 330-H features a constant-mesh transmission, 8 forward and 4 reverse speeds, full-diesel rubber-mounted engine. With hydraulic brakes, ample strength and weight, and a wide range of blade adjustments. Write for bulletin (Form No. M6-174) from LeTourneau-Westinghouse Company, Peoria, Illinois, or circle reply card.

Refuse Incinerators for Every Need

716. . . . including supermarkets, schools, hospitals, restaurants and municipalities may be selected from Bulletin No. 185 of Morse Boulger, Inc., Dept. 160, 80 Fifth Ave., New York 11, N. Y. A feature of the bulletin is a tabulation of basic weight calculation factors for determining the capacity of an incinerator for a given installation. Check the reply card.

Bacteriological Analysis By Membrane Filters

718. . . . is now recognized as a standard technique for water analysis by the American Public Health Association. A 20-page Manual describes the technique and equipment available for laboratory and field examinations of water, milk and sewage solids. Write Millipore Filter Corp., Bedford, Mass., or check the reply card.



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Mueller Gate Valves in your water supply or fire protection system is your assurance of years of maintenance-free service. This fact is due largely to a design-exclusive . . . Mueller's Four Point Wedging Mechanism that assures tight, sure shut-offs. This unique principle exerts equal seating pressure at four points near the edge of each disc to eliminate deflection and distortion. Write for complete information on the variety of ends and wide range of sizes on these AWWA Gate Valves.

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Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

To order these helpful booklets check the reply card opposite page 38.

Nuclear Moisture and Density Instrumentation

710. This 6-page profusely-illustrated brochure describes how to use nuclear gauges for rapid field determination of moisture and density in soils, aggregates, concrete, asphalt, etc. Full specifications of the gauge are provided. Copies are available from Nuclear-Chicago Corp., 359 East Howard Ave., Des Plaines, Illinois, or by returning the reply card.

Ball Valves for Throttling or Pressure Regulation

719. . . . among several types of high pressure service, 150 or 250 psi, and 10" through 48", with resilient seat design are described in Catalog BA-1, which gives dimension and application data. Check the reply card or write Henry Pratt Co., 319 West Van Buren St., Chicago 7, Ill.

For Prompt Service Use The Reply Card

Now Make Your Own Alum!

720. Through this new process that cuts the cost of alum use. These efficient compact plans can provide from 3 to 120 tons a day. Be sure to find out how you can add convenience, save time and costs through this simple new plan. For the full facts address Chemico, Dept. A, 525 West 43rd St., New York 36, N. Y., or circle number on card.

If You Could Reach 100 Feet

721. . . . it would help a lot in working on lighting installations, poles and other hard-to-reach areas—up or sideways, with safety. How the Strato-Tower does this for your crews with ease, speed and economy is the theme of descriptive literature to be had from Ottawa Equipment Div., Young Spring & Wire Corp., Bowling Green, Ohio, or check our card-number.

REFUSE COLLECTION AND DISPOSAL

Increase Your Refuse Collection Efficiency by 20 Percent

123. New principles and features like continuous loading, pre-crushing of refuse, bigger collections per load, safer operation, lower maintenance, faster collections are all described in new Catalog Section 5a. Write for it to Daybrook Hydraulic Div., Bowling Green, Ohio, or—easier—just circle our card-number.

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Bulk Refuse Collection with or without Containers

192. A bulletin describing the bulk refuse system called the Roto-Pak Container System, which provides an unusual flexibility of service and the handling of all types of trash, is available from City Tank Corp., Culpeper, Virginia. Check the reply card.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis Chalmers Mfg. Co., Milwaukee, Wis.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

CONSTRUCTION EQUIPMENT AND MATERIALS

Don't Stand There Figuring!

51. Use the new Forney PSI Calculator "slide rule" for concrete products that includes instant conversion data from total load to psi on 17 standard test specimens and masonry units. Pocket size. Free. Address Forney's Inc., Tester Div., Box 310, New Castle, Pa.

Got to do Asphalt Mixing or Patching?

118. Whatever the job, speed and simplify your work with modern Wylie equipment for hot or cold paving materials. As the first step to improved performance get new data from Wylie Mfg. Co., P. O. Box 7086, Oklahoma City 12, Okla., or use the reply card.

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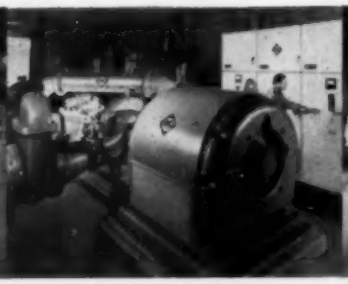

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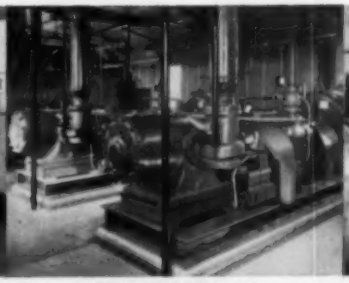

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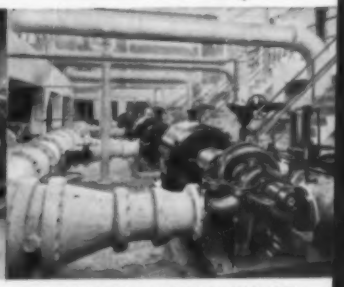
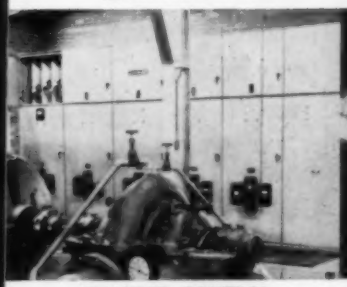


☐ WATER WORKS PUMPS



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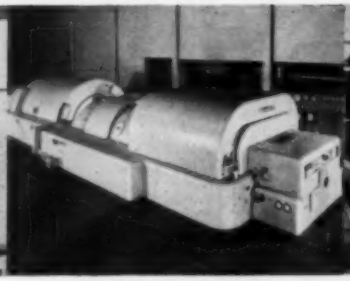
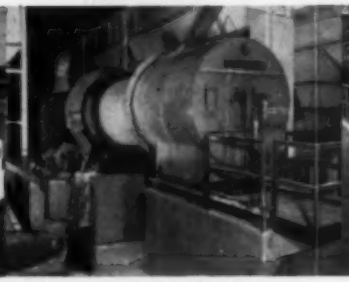


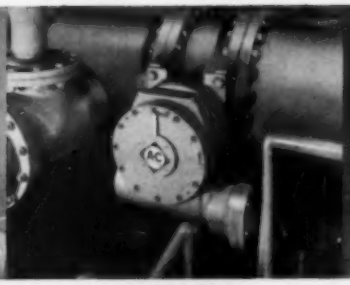
☐ STEAM TURBINES



☐ ROTARY DRYERS

☐ VIBRATING SCREENS

☐ SEWAGE PUMPS



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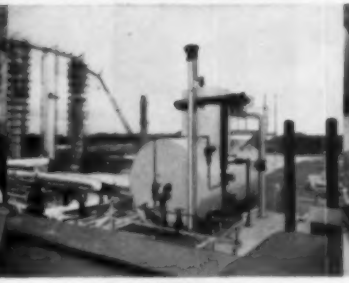

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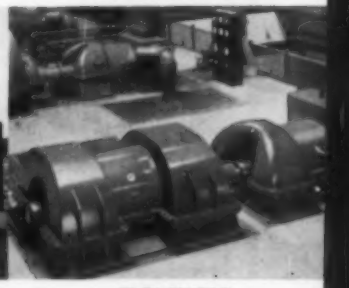

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A-1311

To order these helpful booklets check the reply card opposite page 38.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful four color booklet you will find details on several basic designs for community use; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co. 7321 East 13th St., Kansas City, Mo.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughy Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Information on Trucks for Every Job

632. Literature on the complete IHC truck line is available from Interntional Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Included is information on basic models, conventional and COE, 4-wheel, 6-wheel and four-wheel-drive. Check the reply card.

Attachments For Ford Tractors

643. Clearing, backfilling, ditching, excavating, mowing, scarifying, sweeping, and trenching equipment are a few of the attachments described in literature from Tractor and Implement Div., Ford Motor Co., 2500 East Maple Road, Birmingham, Mich.

Color Catalog Describes "Michigan" Tractor Dozers

631. A 20-page catalog on "Michigan" Models 180, 280 and 380 tractor dozers covers the design and operating features and explains how the hydrulic controls regulate all dozer operations. For your copy write to Construction Machinery Div., Clark Equipment Co., P. O. Box 599, Benton Harbor, Mich., or check the reply card.

Data on Portable and Stationary Air Compressors and Accessories

652. Covered in literature available from Gordon Smith & Co., Inc., Bowling Green, Ky., are the basic designs of portable air compressors, models, operating features and specifications. Check the reply card.

Literature on Concrete Gunning Equipment

695. The application of gunned concrete and allied equipment used for mixing the dry blend mix for this operation is described in Form No. C7-59, furnished by the Air Placement Equipment Company, 1000 West 25th Street, Kansas City 8, Missouri.

RECREATION

How to Equip Your Parks and Playgrounds

414. A handsome 60-page illustrated catalog showing a full line of extra heavy duty playground, park picnic and dressing room equipment, plus many related items, is now available from American Playground Device Co., Anderson, Ind. Complete specifications, construction features, prices and details of labor and materials needed for installation are included. Check the reply card.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 155 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

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567. with this new-type miniature 2-way transistorized radio system. With it you are never out of touch with jobs or personnel. TELEPATH Systems can be worn like clothing. No license required for 27 mc type. Write for literature to SEISCOR, Box 1590, Tulsa, Okla.

STREET LIGHTING AND TRAFFIC CONTROL

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Cut Crime and Accidents

396. . . . with better street and highway lighting. Good design means good lighting standards, arms, bases and luminaires. A catalog, ALS-5, is just out containing working engineering specification data, over 20 drawings and complete and detailed data on various Pfaff and Kendall lighting standards, including luminaire specifications. The entire catalog is cross indexed. Address Pfaff & Kendall, 84 Foundry Street, Newark, N. J.

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Pioneer Snow Plow Builders
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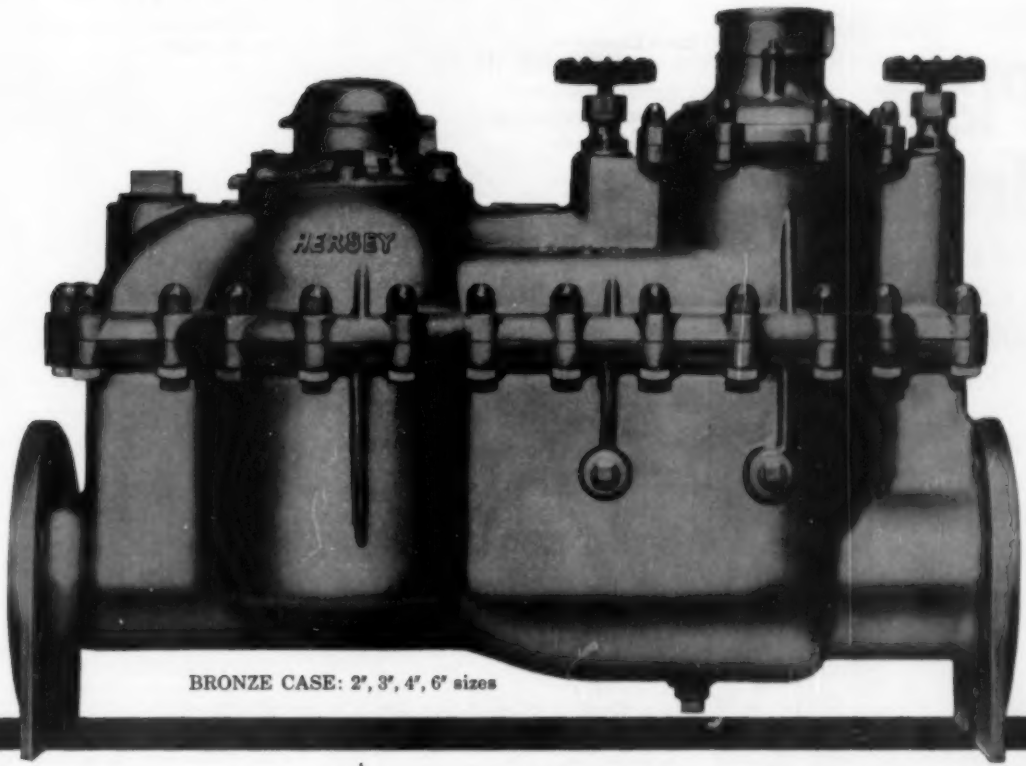

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CURRENT TYPE METER

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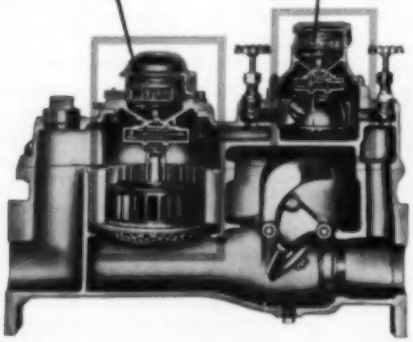

Since 1932 this water meter has been the leader for measuring a wide range of flows. It combines a Current Type Meter (Model T) to measure high rates of flow with a Disc Type Meter (Model HD) to measure low rates of flow. A Hersey Automatic Lever Valve links these meters together, providing an integral device in one casing that accurately measures a larger range of flows than can be accomplished by either type of meter separately. The Automatic Valve is of the compound lever mechanical type which, when opened by a large demand, offers minimum resistance to the flow of water.

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SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Winter Road Maintenance With Calcium Chloride

386. This bulletin contains data on why calcium chloride mixtures work better, how and in what percentages to store, mixing methods and recommendations for various storm conditions. Check the reply card or write Columbia-Southern Chemical Corp., One Gateway Center, Pittsburgh 22, Pa., for your copy.

Plan for Bare Pavements All Winter

470. Helpful folders on clear pavement winter maintenance by use of chemical mixtures are offered by Solvay Process Division, Allied Chemical Corp., 61 Broadway, New York 6, N. Y. Circle number on reply card.

Complete Ice and Snow Fighting Equipment

523. Snow plows in 55 models and 9 types, material spreaders with width of spread of 8 to 20 ft. and hopper capacity of 2 cu. ft., and truck grader ice blades are covered in literature from Wausau Iron Works, Wausau, Wisc.

Salt, Sand and Cinder Spreaders

532. . . . are fully discussed in folder outlining how these are dump body mounted for quick attachment and detachment according to service and season. Basic specifications outlined. Just address Baughman Mfg. Co., Jerseyville, Ill. or use the reply card.

WATER WORKS

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

A Handy List on "In Stock" Pipe

148. . . . is issued monthly by L. B. Foster Co. to show all stock footages of seamless and welded pipe, structural steel pipe and other specialties. Enables you to order pipe with exact knowledge of what is immediately available. Address L. B. Foster Co., P. O. Box 1647, Pittsburgh 30, Pa., or you can just check number on our card.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

High Frequency Resistance— Welded Steel Pipe . .

72. Available in 6" to 16" diameters, in wall thickness to .219, special wrappings and coatings available. For attractive booklet, including specifications and details of field joints write Valley Mfg. Co., Valley, Neb., or circle our inquiry card.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Valve and Hydrant Construction Details

161. A 72-page catalog-type bulletin, just completed, gives detailed data on construction and application of gate valves, check valves and hydrants for water works service. Write for Bulletin 5710 from Darling Valve and Mfg. Co., Williamsport, Pa., or check the reply card.

Use The Reply Card

Meters and Instruments For Water Works

224. An attractively arranged 40 page catalog in full color issued by Hersey-Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 314.

Do You Know the Value of the V-Notch?

295. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or check the card-number.

Water, People and Hydrodynamics

302. . . . is the title of an illuminating booklet dealing with the world-wide problem of how to get water in adequate supply, when and where needed. Your copy can be had for the asking of Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill., or use the reply card.

Locate Water Leaks Quicker and Easier

476. An aquaphone that requires no mechanical connection between probe and diaphragm to break or cause of trouble is described fully in literature from Aqua Survey & Instrument Co., 824-B North Bend Rd., Cincinnati 24, Ohio.

Halve Your Time on Pipe Pushing and Pulling

517. Continuous-motion machine works all the time to keep pipe moving fast until it is through. Hand or air powered. Write for new folder to The Trojan Mfg. Co., 1112 Race Drive, Troy, Ohio, or use our reply card.

Case Model 750 tractor-shovel...
1¾ cu. yd. (heaped); 1⅛ cu. yd. SAE Rated capacity; 11,000 lbs. breakout; 16,000 lbs. lift; 23,000 lbs. crowd; max. dump ht. of 8'; forward reach over 43" at 7' ht.

or Power-Angling Dozer
gives you hydraulic blade angling, up to 25° right or left — on-the-go.

or Power-Tilting Dozer
lets you hydraulically drop either corner of the blade to 13" — on-the-go.

NEW CASE® 750

The one-size tractor "most wanted" by the majority of crawler users! Powered right, priced right; with all the "big-rig features" you need to handle a wider variety of both large and small jobs at highest net profit.

Here, at last, is a versatile, big production crawler that is truly engineered for the competitive 60's. Compact, rugged, yet surprisingly economical to own and operate, the 72 hp diesel Case 750 offers big tractor features and lower price, plus a new concept in serviceability.

World's Most Effective Tractor Transmission

Job-proved on Case crawlers since 1955, the exclusive, hydraulically-operated Case Terramatic® transmission gives the "750" unequalled maneuverability and handling ease. You get split-second power-shifting, effortless power-steering, plus independent power control of each track. You just touch a hydraulic foot brake to make sharp pivot turns — *no hand or foot clutching!* Or you can operate one track fast, the other slow to turn gradually with *full power* on *both* tracks — a big advantage when you're moving heavy loads in mud, cutting along hillsides, turning trailing loads on downhill runs.

One-Hand Tractor Control

With just fingertip pressure on handy hydraulic controls, you reverse direction without clutching... change speeds from high to low, low to high "on-the-go". This easy one-hand operation — combined with exceptional power, speeds to 6.6 mph, and elimination of time-wasting motions — enables the Case 750 to handle a wider variety of work at highest net profit per job.

A New High In Usable Power

The "750" is powered by a 301 cu. in., Case-built diesel engine — proved in over 15 million hours field use. Also, the "750" is equipped with "load-sensing" torque converter that instantly, automatically adjusts power to changing loads and tractive conditions. Result: the "750" moves bigger payloads at higher average speeds — without clutching, shifting, or stalling.

Long-Life Track System

Proven on larger Case units, the "750's" track system is designed to take the punishment imposed by fast, non-stop cycling. *You get up to twice the work output of ordinary crawler tracks.*

Exclusive Case torsion suspension absorbs shocks... increases traction... keeps bucket or blade level — even when the front of one track is raised as much as 10 inches higher than the other.

Easy Access, Simple Maintenance Cuts Downtime

To mention just a few of the "750's" downtime-cutting features — there's hydraulic track adjustment, automatic roller lubrication, swing-out grille guard, tilt-forward cowl and *dual fan belts.*

Get the facts from your Case Industrial Dealer now. Ask to see the sound and color action movie on the new "750". Learn why this "years-ahead" Case crawler loader or dozer will help you increase your profits this year as well as *throughout* the competitive 60's. CT-L-539

CASE®

J. I. CASE CO., RACINE, WIS.

To order these helpful booklets check the reply card opposite page 38.

To Meet Increasing Water Demands, These Two Steps Will Help

247. Two new products designed to help meet constantly increasing demands for water are described in a folder of Hersey-Sparling Meter Co., 250 Elm St., Deham, Mass. These are a flow analyzer that provides strip chart rate of flow and volume records, and a two-rate register that can be substituted for the flow analyzer. Get this data by checking our reply card.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.

Gate Valves

369. A new publication has been issued especially for designers of sewage and waste treatment plants. Write for Circular No. 24 to M & H Valve and Fittings Co., Anniston, Ala., or check the card-number.

Are You Using the Right Coagulant?

381. This question, and its answer, are included in new folder that packs much valuable guidance in water and sewage treatment. Read a little and learn a lot. Write to Tennessee Corp., Box 2205, Atlanta 1, Ga., or circle our card-number.

Badger Read-o-Matic Register For Outside Water Meter Reading

536. The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply card or write Badger Meter Mfg. Co. 4545 West Brown Deer Road, Milwaukee 23, Wisc.

To Insert Valves Under Pressure . . .

555. . . . . let your first step be review of this "step-by-step" folder on Mueller tapping and cutting-in sleeves and valves. Write Mueller Co., Decatur, Ill., for Form W-8899 or circle number on our card.

Technical Bulletins to Design or Check by . . .

600. for water and sewage plants. They are now available as No. 100 on Venturi tubes; No. 720 on supervisory control; No. 1003 on mechanically operated rate-of-flow and loss-of-head gauges; No. 1004 on pneumatic single and double indicating receivers; and No. 1225 on controlled closing air valves. For the set, write Simplex Valve and Meter Co., Lancaster, Pa., or circle our card number.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 101 North 17th St., Kansas City, Kans., for literature.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Play Safe with Automatic Controls

603. Remote engine and pumping controls of every sort are fully described in a series of bulletins offered by Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill. Write them or circle the above number on our card.

Streamlined and Modernized Fire Hydrants

607. Models, dimensions and advantages of the Eddy fire hydrant are covered in bulletin from the Eddy Valve Co., Waterford, N. Y. Check the reply card for complete details.

Keeping Up-to-Date on Fire Hydrants . . .

608. will be made more certain by having this latest folder on Iowa hydrants in your files. Dependable design; ground line break flange construction. Ask for Bulletin X9 of Iowa Valve Co., Oskaloosa, Iowa, or circle the reply card.

Use The Reply Card

When the Frost is on the Meter

615. If it is an American frost-bottom meter freezing is no major problem. The replaceable center section breaks out leaving the mechanism undamaged. Bulletin 58 tells the story. Address Buffalo Meter Co., Inc., 2917 Main St., Buffalo 14, N. Y., or circle reply card.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

RADAX® PREFABRICATED BROOMS

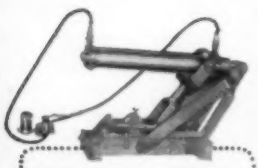
NO CORES TO BUY
2 MINUTES TO INSTALL ON YOUR OWN CORE
WEARS FOR MONTHS
SWEEPS CLEAN
ASK FOR A DEMONSTRATION

PRICES DELIVERED TO YOUR SHOP

SWEEPER MAKE and MODEL	SR FILAMENT	TYNEX NYLON
MOBILE 54" BROOM	$195.85	$293.15
MOBILE 58" BROOM	$208.30	$310.60
WAYNE 450, 460, 520 and 550	$169.75	$252.50
ELGIN STREET KING	$258.20	$388.10
ELGIN WHITE WING	$258.20	$388.10
ELGIN 20, 30, and 81	$270.15	$399.95
AUSTIN-WESTERN 40	$208.15	$303.55
AUSTIN-WESTERN 60	$230.75	$333.20

RYNAL CORPORATION
114 ST. JOSEPH ST., ARCADIA, CALIFORNIA

Only the Trojan Pipe Puller & Pusher
gives you continuous action . . .
No Resetting of Grip!



CUTS COSTS! SAVES TIME- in installing or renewing pipe under pavement

The Trojan combines pushing and pulling operations in one machine—eliminates all time-killing resetting of grip—keeps pipe continuously moving. Does the job at lower cost—in far less time.

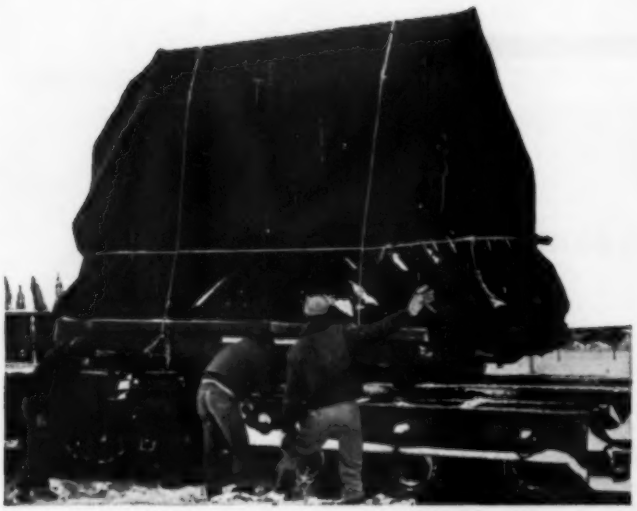
Model A weighs 65 lbs.—requires only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible. Also available for ½" pipe.

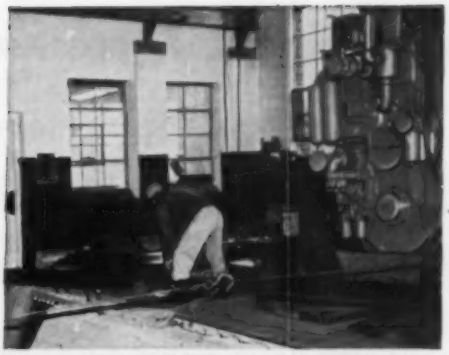
Model B (either manual, hydraulic or air powered) needs only a 6' trench—has 3 speeds for different soils—is reversible in 30 seconds. Push pipe comes in 30" lengths, assures straight travel.

NEW AIR POWERED Model B
Does all the work for you. Handles ¾" to 2" pipe.

Write today for full details!

The TROJAN Manufacturing Co.
1114 Race Drive • Troy, Ohio





The Enterprise DGSQ Turbocharged Dual Fuel engine is moved into place as a unit. With 16" bore and 20" stroke, it is rated 1422 HP at a speed of only 360 RPM.

Fourth Enterprise Engine arrives at Belleville under protective wraps of all-weather tarpaulin. This new addition adds 1000 KW to plant's capacity.

Bright Power Picture at Belleville: Better Schools and Streets, with Lower Taxes!

"We recently installed the fourth Enterprise Engine in our 100% Enterprise Dual Fuel plant. Our excellent experience with this equipment over the past eight years has proved it to be our best buy in engines. Operating and maintenance costs have been consistently low, greatly reducing power costs and helping make Belleville one of the most thriving and progressive cities in the middle west. We have better schools and streets, lower taxes, above-average recreational facilities, and many other advantages enjoyed by only very few cities of similar size."

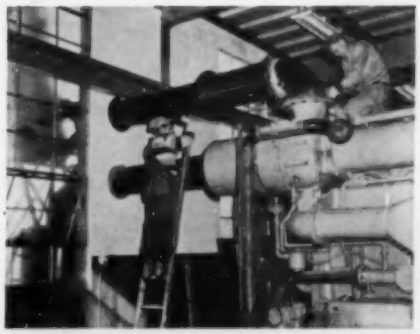
Earl E. Whitney, City Manager
Belleville, Kansas

City managers, municipal engineers, superintendents — all those concerned with the growth, the future, the prosperity of their community, can look to Enterprise Engines confident they will get this same kind of dependable and economical power-generating performance.

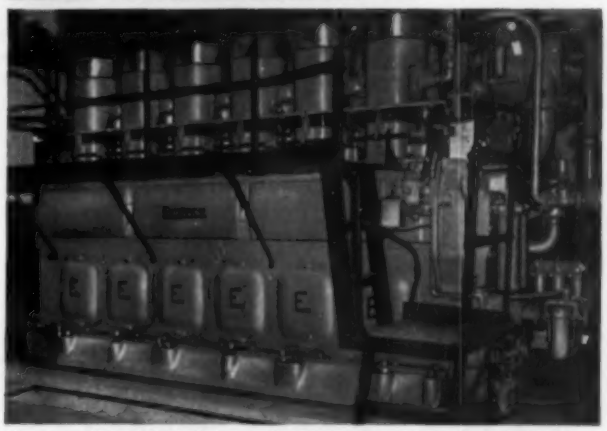
Enterprise Engines — Diesel, Dual Fuel, Spark Ignited Gas — serve every municipal need

The most modern engineering advances are reflected in every Enterprise model, from 73 to 6933 HP, for stationary or portable electric service, flood or water pumping systems, sewage plant power. See the Enterprise sales engineer in your area, or contact us direct for information or help with your plans.

Over a million horsepower at work the world over!



Installation nears completion as exhaust stack and muffler are installed. This "all Enterprise" plant, with its 2500 KW capacity, now has ample dependable reserve power for any emergency, future growth.



New member of the all Enterprise power team is cut in on the line. Low maintenance cost, excellent service record, and over-all economy of the Enterprise engines already in use were the big factors in its selection.

ENTERPRISE *Diesels*

THE DEPENDABLE

Enterprise Engine & Machinery Co., Subsidiary of General Metals Corporation
18th & Florida Streets, San Francisco 10, Calif. • National and worldwide sales and service.

FOR FAST, ECONOMICAL

SURFACING OR REPAIRS, USE

A *McConnaughay* HTD MIXER

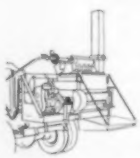
HTD MIXER
No. 10

Here are the mixers you need for fast, economical pavement repairs and small surfacing jobs... in any season... under wet or dry conditions. They are precisely engineered and rigidly constructed to handle on-the-job mixtures of asphaltic concrete, sheet asphalt, sand asphalt or mastic asphalt... hot or cold... at remarkably high production rates and lowest possible costs. Write for our folder on the complete line of mixers as well as for specifications and proportioning tables.

HTD MIXER No. 10
½ ton per batch

HTD MIXER No. 8
⅓ ton per batch

HTD MIXER No. 5
¼ ton per batch



HTD MIXER No. 4-T
⅓ ton per batch

McCONNAUGHAY MIXERS, INC.—LAFAYETTE, IND.

National distributors: Asphalt Equipment Co.
3314 Cherry Lane, Fort Wayne, Indiana

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

You Don't Need a Big Plant to Get Big Savings

21. . . . in mechanical sludge dewatering. Now the smaller plant can cut power costs, eliminate use of chemicals and reduce labor. 4-page bulletin on the "Roto-Plug" sewage sludge concentrator shows how this is accomplished. Write for Bulletin 100 to Nichols Engineering & Research Corp., 60 Pine St., New York 5, N. Y., or check the card-number.

Equipment For Water, Sewage and Industrial Waste Treatment

24. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Use The Reply Card

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Rated Aeration Now Can Be Had in a Package

112. Chicago Pump's aerobic digestion sewage treatment plant is available as a factory assembled unit combining comminution, diffused-air aeration and settling for 1,000, 3,000, and 5,000 gpd loads. Write for bulletin on Rated Aeration SS, Chicago Pump, Food Machinery and Chemical Corp., 622 Diversey Parkway, Chicago 14, Ill., or check the reply card.

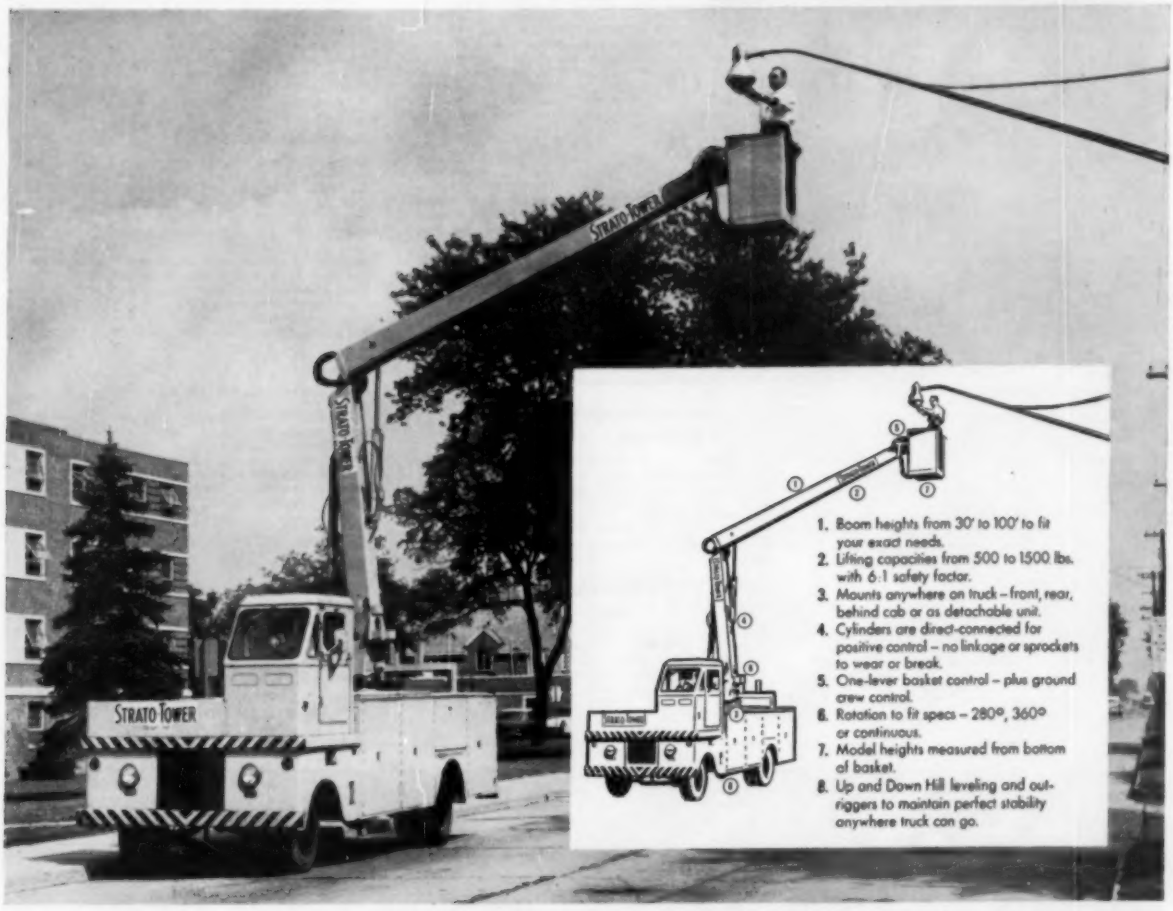
Hand/ Reference on Centrifugal Pumps

115. Basic pump models, closed or open impeller and self priming solids handling series with models up to 8" size are presented in Form 9-IP-11 of Gorman-Rupp Co., 305 Bowman St., Mansfield, Ohio. Performance curves and lists of features make this a useful reference. For yours, check the inquiry card.

Elliptical Concrete Pipe for Sewers and Culverts

143. A 4-page bulletin is available from United States Concrete Pipe Co., 1500 Union Commerce Bldg., Cleveland 14, Ohio, on the use of elliptical pipe to obtain round pipe flow equivalents in certain areas. Check the reply card for diagrams, data charts and tables that fully describe elliptical pipe sizes and compute discharge flow rates for the full range of pipe sizes.

OTTAWA


STRATO TOWER
STRATO TOWER
1. Boom heights from 30' to 100' to fit your exact needs.
2. Lifting capacities from 500 to 1500 lbs. with 6:1 safety factor.
3. Mounts anywhere on truck – front, rear, behind cab or as detachable unit.
4. Cylinders are direct-connected for positive control – no linkage or sprockets to wear or break.
5. One-lever basket control – plus ground crew control.
6. Rotation to fit specs – 280°, 360° or continuous.
7. Model heights measured from bottom of basket.
8. Up and Down Hill leveling and outriggers to maintain perfect stability anywhere truck can go.

up to 100' extension to your arm –

STRATO-TOWER

With a simple flick of the exclusive Strato-Tower single-lever control, work crews position themselves in the exact elevated spot they need. They do it safely, too...Strato-Tower's exclusive Up and Down Hill leveling lets the crew work *anywhere* the truck can go Hydraulic outriggers insure stability—fiberglass booms and buckets isolate crews from high voltage – insulated booms protect on low voltage lines. And, Strato-Towers are structurally built with a six to one safety factor – an extra margin of safety.

See your Ottawa Distributor or send the coupon for full details on the Ottawa Strato-Tower. Equipment Division, Young Spring & Wire Corporation, Bowling Green, Ohio.

OTHER EQUIPMENT DIVISION PRODUCTS

OTTAWA

- HYDRA-HAMMER – Pavement Breaker and Compactor
- MARAUDER – Self-propelled Backhoe and Loader
- BACKHOES AND LOADERS – for most wheel and crawler tractors

DAYBROOK

- POWER CRANES – 7000 lb. lifting capacity
- POWER GATES® – 800 to 5000 lb. capacity
- DUMP BODIES – 1½ to 27 cubic yards
- HYDRAULIC HOISTS – From 3 to 39 tons

EQUIPMENT DIVISION
MANUFACTURERS OF
DAYBROOK
TRUCK EQUIPMENT AND
OTTAWA
CONSTRUCTION EQUIPMENT

YOUNG
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CORPORATION

SEND ME MORE FACTS ON THE OTTAWA STRATO-TOWER

- ☐ Complete descriptive literature
- ☐ Specifications of the.....-foot boom
- ☐ Name of my nearest Ottawa Dealer

Name.. .....
Address.....
City..... ..... State.....

To order these helpful booklets check the reply card opposite page 38.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif.

Manual on Sewer Structures

178. This is a 48-page manual on installation design, reference data and graphs showing discharge of pipe based on Manning's formulas. Also such subjects as structural durability, material durability; selection of structures; factors influencing capacity; joints and fittings; and linings for failing sewers are covered. Copies of Manual CMS-7456 are available from the Product Information Service, Armco Drainage & Metal Products, Inc., Middletown, Ohio, or by checking the reply card.

Factory-Built Pneumatic Sewage Lift Stations

191. Design features and operational characteristics of the Smith & Loveless factory-built "Du-O-Ject," a duplex pneumatic ejector sewage lift station made in 30 to 200 gpm capacities, are presented in four-color, 6-page Bulletin 616-A. Included is a fold-out drawing which points out every major feature of mechanical and electrical equipment. Write Smith & Loveless, Box 8884, Kansas City 15, Mo., or use the reply card.

How to Save $264 per Mile

216. . . . in sewer cleaning is the gist of a new 8-page brochure that discusses just how such savings can be accomplished. It costs nothing to find out and it may be your best investment of the day. Write for it to Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif., or circle the card-number herewith.

Rubber Joints for All Types of Concrete Pipe

205. . . . are described and their advantages outlined in a new Engineering Manual which engineers in particular, will find valuable with respect to physical properties and performance characteristics of rubber compounds used in such joints. Plenty of on-the-job illustrations of value to contractors and all pipelayers. Address Hamilton Kent Mfg. Co., 427 W. Grant St., Kent, Ohio, or check our card-number.

Foxboro Magnetic Flow Meter

238. The Foxboro magnetic flow meter measures water and wastes electrically, without any line restriction. No loss of head, no fouling, even with slurries. For detailed illustrated Bulletin 20-14B check the reply card or write The Foxboro Co., Foxboro, Mass.

For Prompt Service Use The Reply Card

New Data on Straightline Sludge Collectors

292. . . . is in a 28-page new booklet, with engineering data on these Collectors that will enable you readily and economically to design water, and sewage or industrial wastes treatment projects. Published by Link-Belt Co., Colmar, Pa. For your copy contact your nearest Link-Belt office, or just circle our card-number.

Send TV into Your Pipe For a Better Picture

421. . . . than you can get by personal inspection. Whether it is sewers or water mains, find out now what closed-circuit TV can do to provide inside inspection with photographic records. Get the facts folder from National Power Rodding Corp., 1000 South Western Ave., Chicago 12, Ill.

Read Your Sludge Consistency

296. Eliminate any problem associated with maintaining proper sludge consistencies for better operating efficiency. Circular describes how this new Automatic Pump Control "reads" sludge condition and controls your pump operation more unerringly than any human. Address Komline-Sanderson Engineering Corp., Peapack, N. J., or ring the number on card.

Amvit Mechanical Jointed Clay Pipe

298. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Manual on Construction Castings

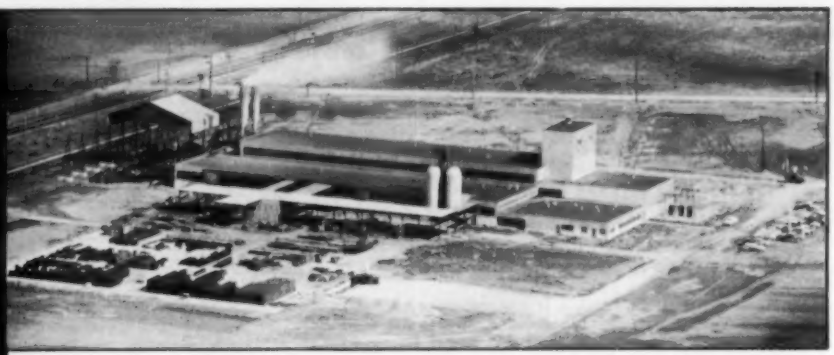
462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

(More listings on page 46)

500 TONS OF CASTINGS DAILY!



With the recent opening of plant #2, shown above, our production potential of Gray and Ductile Iron Construction and Industrial Castings has now reached a maximum of 500 tons daily. This capacity, plus 15,000 patterns, plus a good on-hand supply of standard castings, plus 90 years experience in the business, is your assurance of prompt delivery, superior quality, complete uniformity and practical economy.

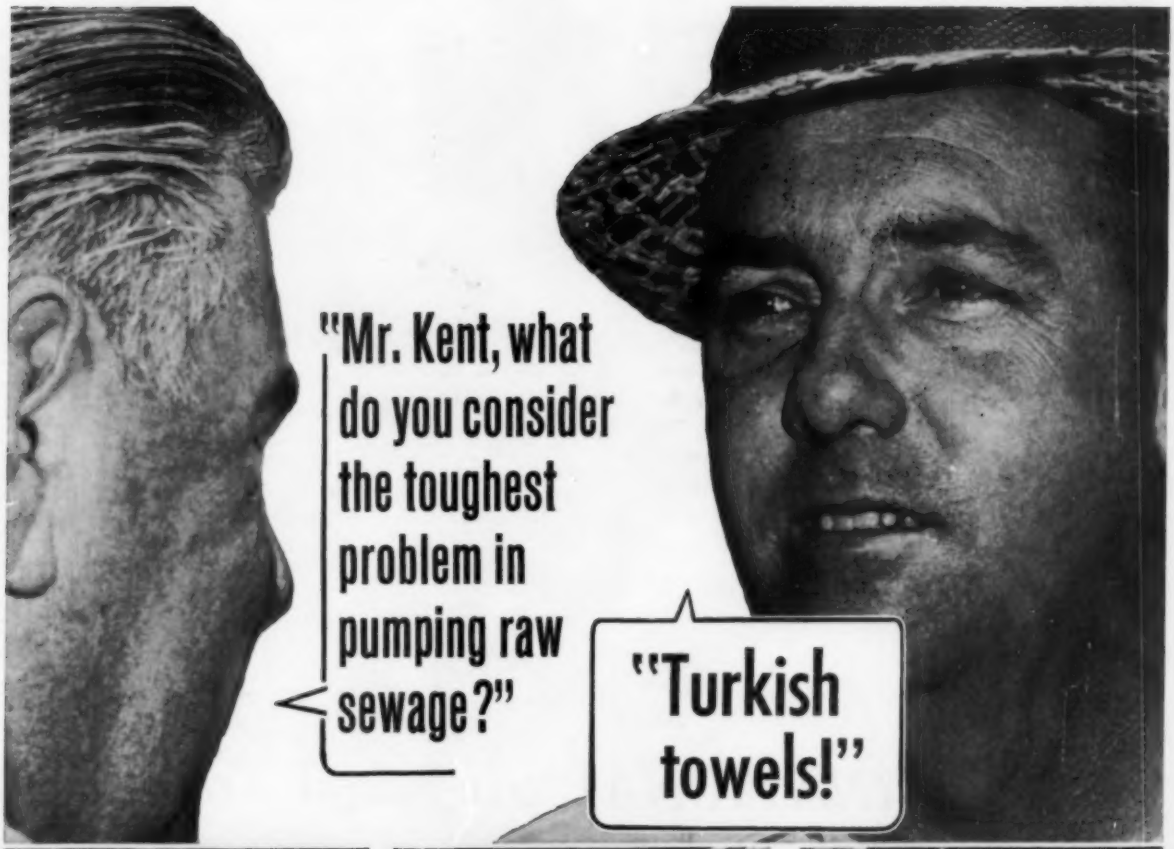
* * *

New and fully illustrated 168-page catalog of construction castings will be sent promptly upon request.

NEENAH FOUNDRY COMPANY

NEENAH • WISCONSIN

Chicago Office: 5445 North Neva Avenue, Chicago 31, Illinois

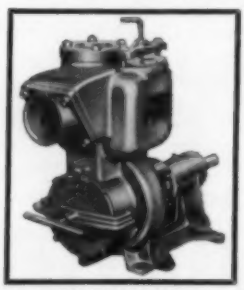


End Plate off

Towel out

End Plate on

"Towels can jam the works, but good!" says Cecil Kent, owner, Sanitation Service Company, Jacksonville, Florida, "I've had 'em clog conventional pumps so bad, it meant a shutdown from two hours to two days.



Model 14A2-B Sewage Pump

"That's why I've standardized on Gorman-Rupp sewage pumps. And what a difference! Fewer shutdowns . . . clogging cleared in just three to fifteen minutes! This cuts average maintenance costs from $120 to only $12 per pump per year. On my 21 Gorman-Rupp pump installations, that adds up to a whopping big saving. Over $2200 a year on parts, packing, materials, and labor.

"Sure, I had a problem—but *no more!*"

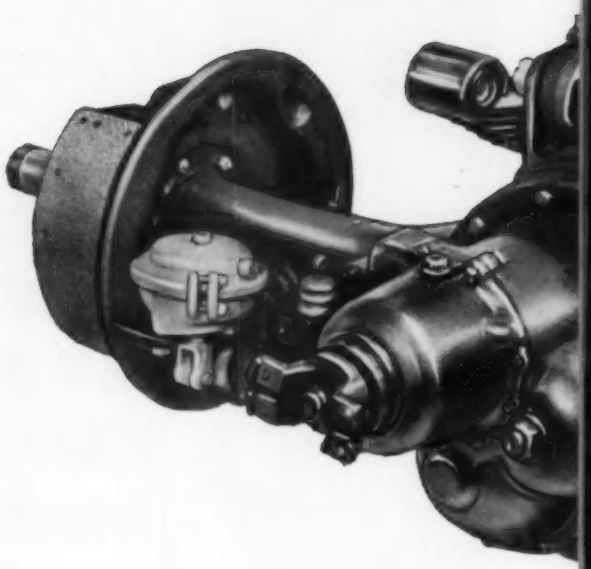
Thrifty, trouble-free, self-priming Gorman-Rupp sewage pumps —2", 3", 4" or 6" sizes—can be connected to your power or ordered complete with power units. Write for complete specifications.

THE GORMAN-RUPP COMPANY

305 Bowman Street **Mansfield, Ohio**

Gorman-Rupp of Canada, Ltd., St. Thomas, Ontario

Hours of twist tests and road tests proved the quality and endurance of new IH bogies.



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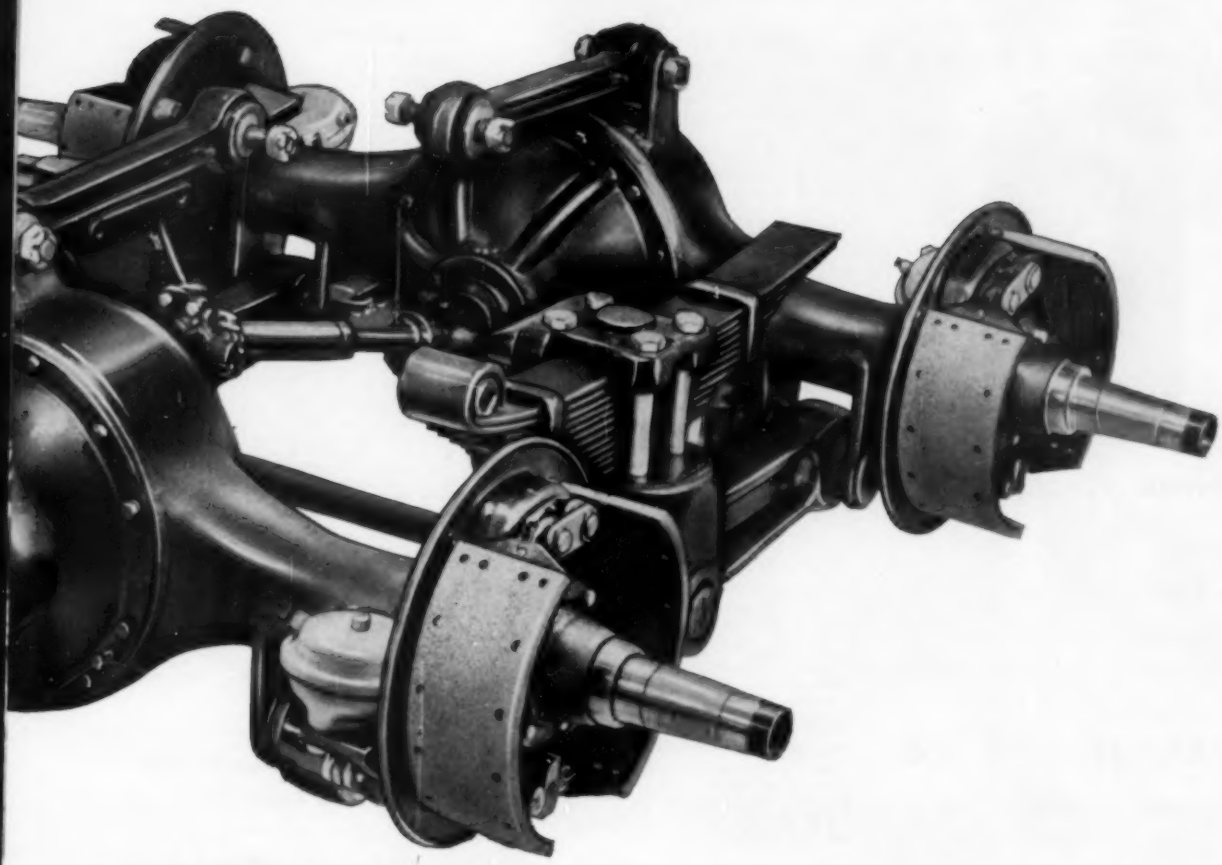

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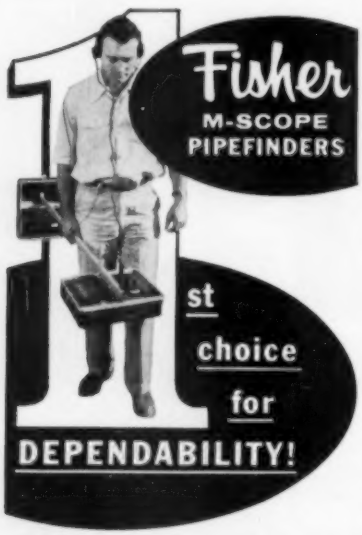

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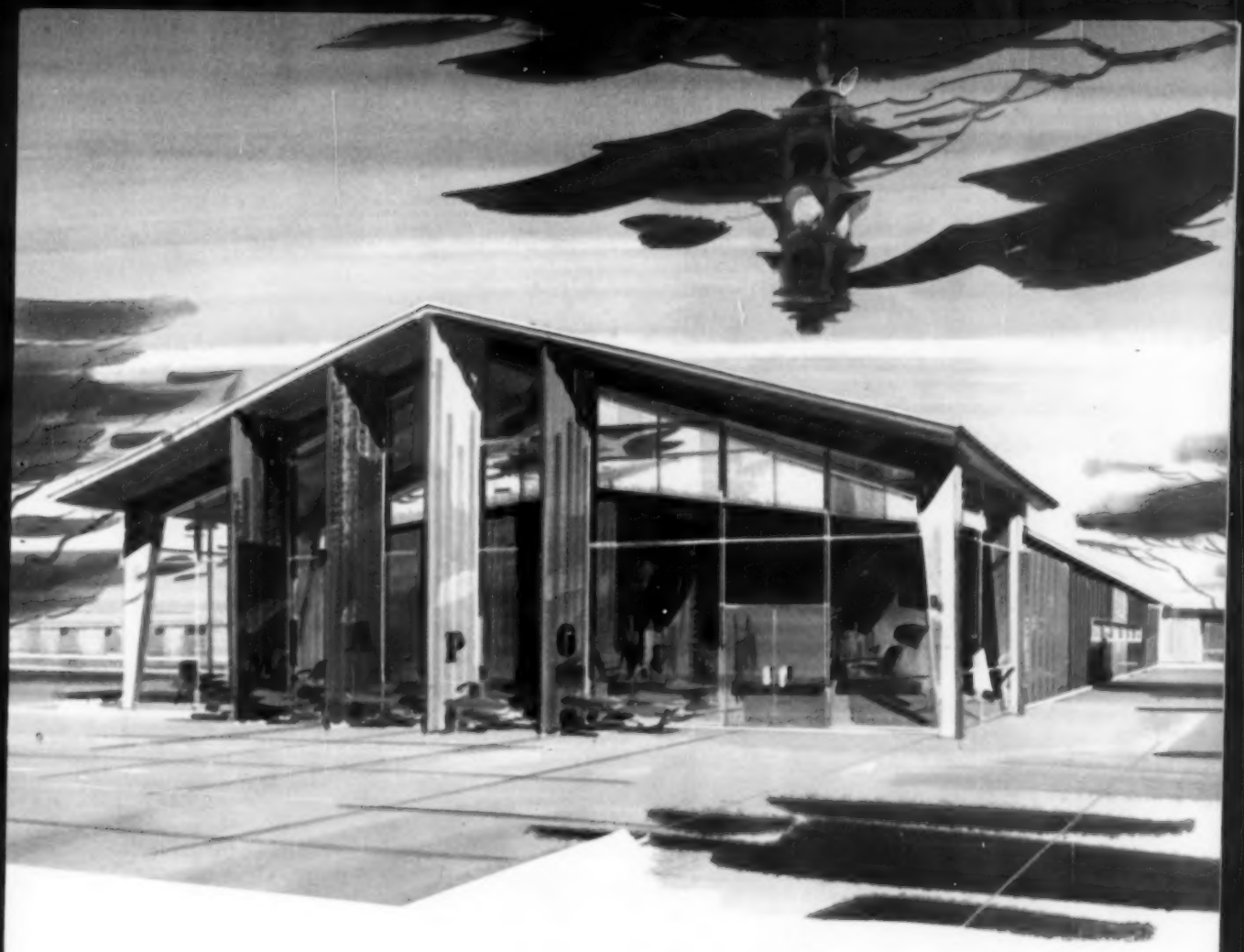

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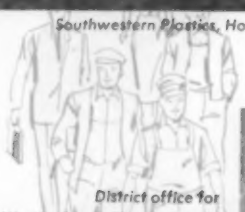

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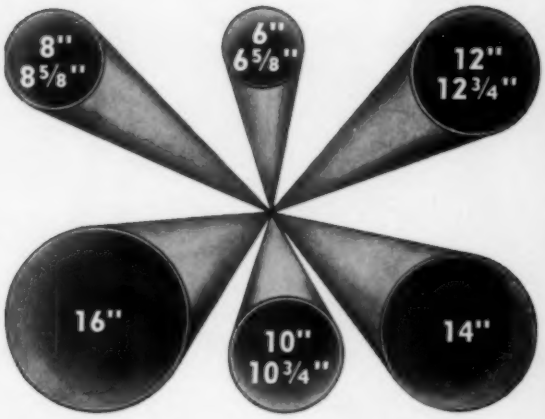

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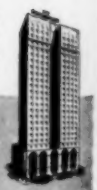

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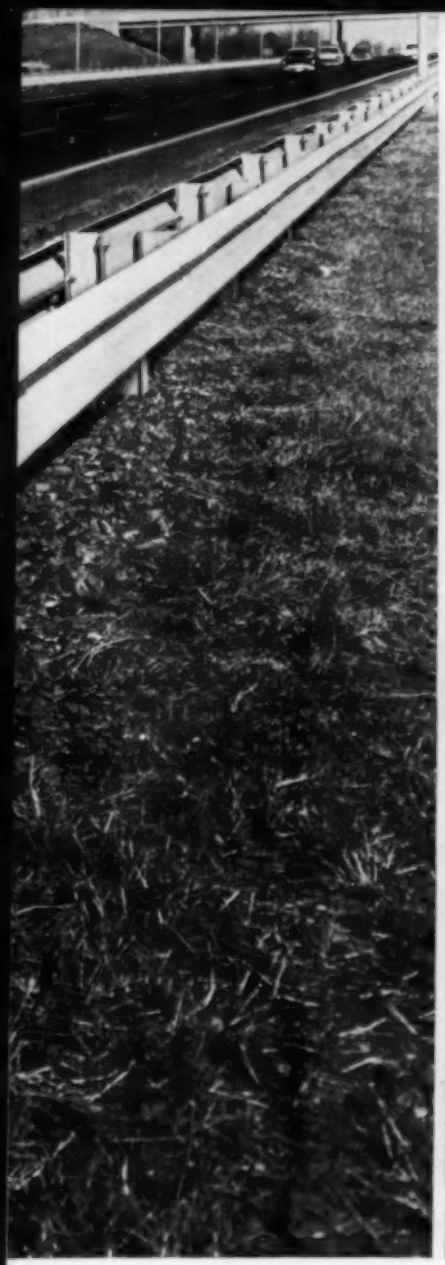

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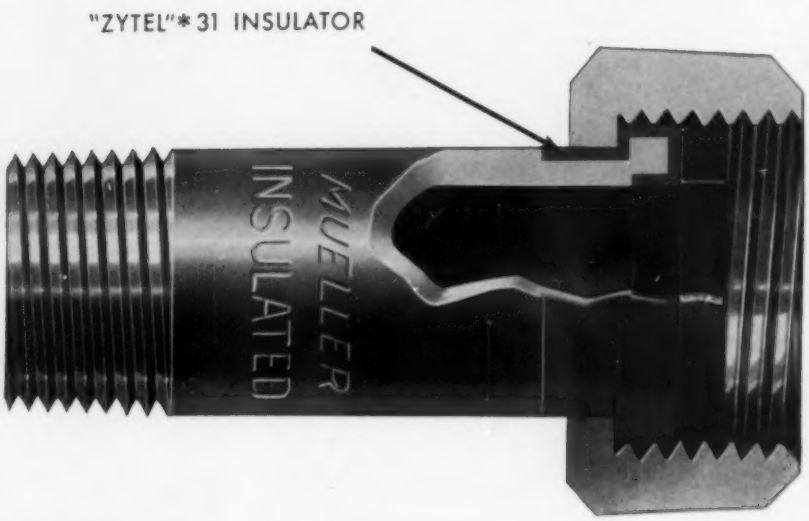

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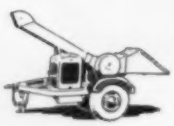

ASPLUNDH CHIPPER COMPANY
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Ed Cleary Says:

Let's Do the Obvious Let's Get Going

EDWARD J. CLEARY
Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

WITHIN THE halls of Congress, and outside as well, there is swelling impatience with what is termed "lack of progress" in water-pollution control. Congressional dissatisfaction is manifested in proposals that range from increasing federal subsidies for municipalities to a revamping of administrative relationships, notably with regard to activities of the Public Health Service. Equally vociferous are the criticisms originating on the local, state and regional scene.

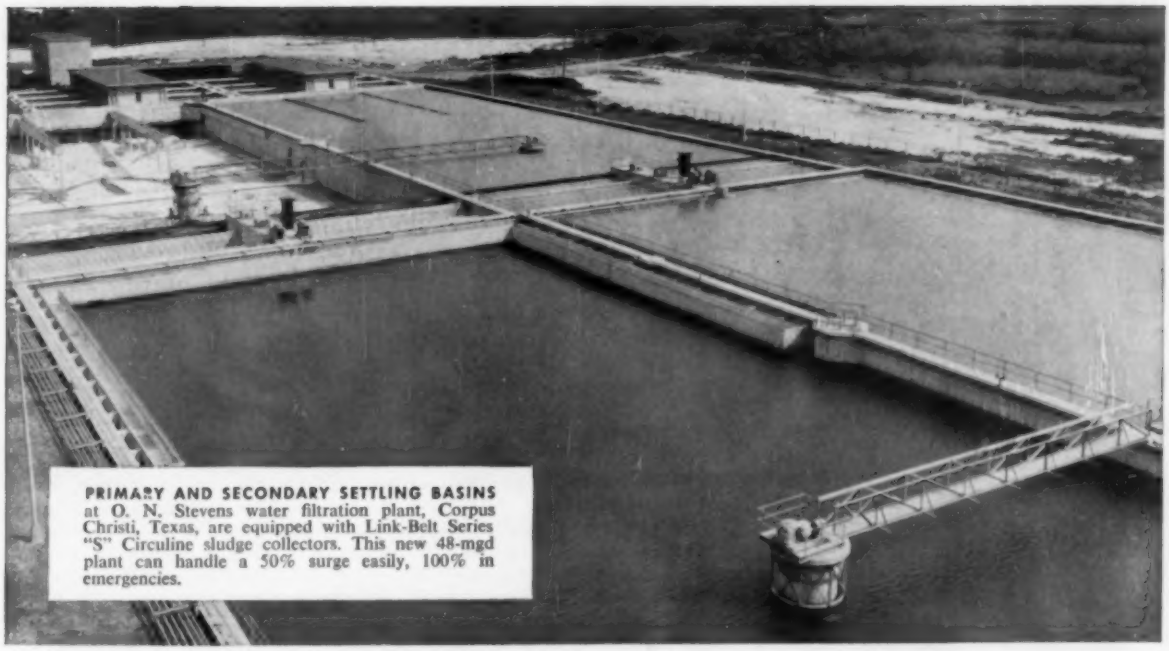
Painful as this must be to those who have been working assiduously on the problem—and with some notable achievements to their credit—the prevailing popular view is that very little is being accomplished. This state of affairs compels examination by the sanitary-engineering profession, at least by those who are engaged in the administration of pollution control.

Reasons for a Dim View

In probing reasons why the public should harbor such a dim view of the situation one might suggest this probability: The public is concerned with a different—and more obvious—set of values than the professional in gauging progress or the lack of it. It matters little to the citizen, for example, that the BOD load to a river may have been reduced by 85 percent when he can see, for example, the discharge of blood from an abattoir or some other revolting reminder of pollution. And it is small comfort to the members of a yacht club to be informed that industries upstream have succeeded in curbing the discharge of suspended solids when their river is so covered with an oily film that a scheduled regatta must be called off.

Examples of obvious pollution such as these are not infrequent, even in those areas where regulatory agencies are doggedly pursuing a systematic and comprehensive program of control. With only limited manpower and resources a regulatory agency must make a choice of priorities—and the discharge of blood from an abattoir may be judged to be of secondary consequence compared to the agency's overall objectives. But is it? Not by the standards employed by the public! The public is basing conclusions on what is seen and smelled, and not on such sophisticated parameters as coliform-index numbers.

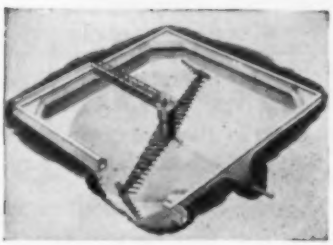
This prompts the question: Would it not be advantageous for regulatory agencies to shift emphasis from some of the slow-moving, comprehensive types of effort in favor of dealing more aggressively with the immediate problems of correcting obvious pollution? It should require no river surveys, statistical evaluation of data and the preparation of detailed reports to curb the discharge of oils and scums and color-producing effluents. If it does, then something is wrong with the laws on pollution control or with



PRIMARY AND SECONDARY SETTLING BASINS at O. N. Stevens water filtration plant, Corpus Christi, Texas, are equipped with Link-Belt Series "S" Circuline sludge collectors. This new 48-mgd plant can handle a 50% surge easily, 100% in emergencies.

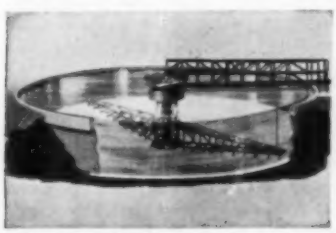
Four series of LINK-BELT Circuline collectors

offer positive sludge removal

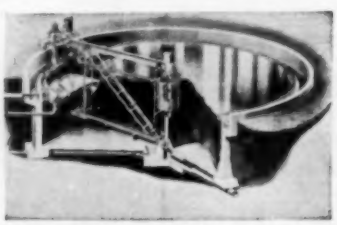


SERIES "S" — specially designed for square and rectangular tanks. As collector revolves, pivoted arms on ends of rakes adjust to thoroughly remove sludge from basin corners.

SERIES "R" — available in models for bottom feed, side feed or cross flow applications . . . in a wide range of sizes. Pitched blades gently convey sludge to center of tank.



SERIES "T" THICKENER — for rugged duty. Similar to "R" collectors except for heavier design. Furnished with fixed rake and automatic or manual lift types.



SERIES "C" — uses simple, positive traction drive to rotate bridge. Slow-speed straightline collector, with long-wearing, corrosion-resistant chains, removes sludge.

There's a design to fit any requirement of tank capacity or construction

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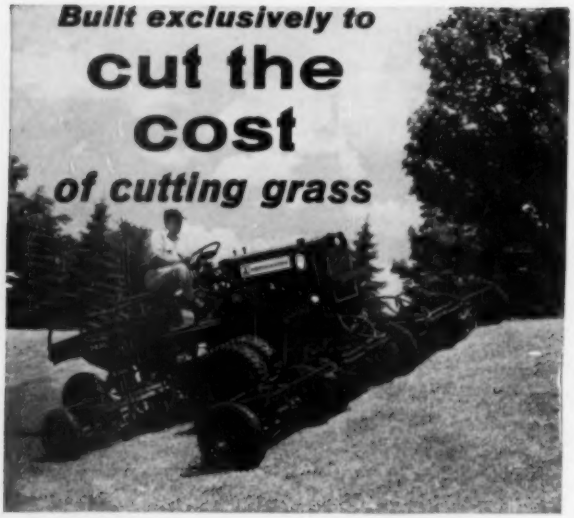

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the attitudes of those who are charged with their enforcement. At least, that must be the verdict of the citizens who are outraged by what they see in some of our streams. And it might be noted that millions of citizens who heretofore were far removed from scenes of stream degradation are now—thanks to the boom in boating and other forms of water recreation—intimately posted on conditions.

West Virginia Faced an Issue

A good example of giving attention to the obvious may be found in West Virginia. Here the State Water Resources Commission, which administers pollution control, tackled the problem of "black streams" on a pragmatic basis. Many West Virginia streams have long been famous—or shall we say infamous—for carrying coal silt, which was indiscriminately discharged from preparation plants. For years the over-burdened control authorities labored in the development of stream classification and related elements of a comprehensive abatement program.

Meantime, the streams became blacker and blacker with coal silt. Finally, one of the commissioners is reported to have said: "To hell with this planning business; let's stop classifying and start cleaning up some of these streams." As a result the public today can see several hundred preparation plants complying with state orders to cease the discharge of coal fines. Incidentally, the coal operators should have no reason to be unhappy—at least one of them is salvaging daily up to 500 tons of coal formerly washed downstream.

Speaking of coal fines, one should not be unmindful of the clean-up of the Schuylkill River about ten years ago. And those who have been deprecating progress in pollution control apparently have forgotten what was accomplished by the Sanitary Water Board of Pennsylvania in bringing about the restoration of this river. Not only have unsightly coal-discharges been stopped and removed, but this action paved the way for curbing other forms of pollution as well.

Accentuate the Positive

In recalling the Schuylkill clean-up—and some other rivers in our nation might likewise be cited as having benefited from the conscientious efforts of state regulatory agencies—it should be remarked that few articles in the popular press have given cognizance to the positive aspects of pollution abatement. Instead, the public is being liberally exposed to the gloom-and-doom theme. It is fact, of course, that the problems of pollution control are great in magnitude and costly to cope with. But this does not gainsay that they are being ignored, nor that little is being accomplished. Simply to examine the sewage-treatment budgets of thousands of municipal public-works departments conveys a contrary view.

It seems odd, too, that among the sanitary-engineering profession the preferred approach in addressing the public on pollution control is to stress the negative. Perhaps this is the unhappy outcome of too much frustration in carrying out the task. Or it might stem from the belief that such an approach is the only way to win sympathy and support for the cause espoused. Whatever the reasons, the results have not inspired public confidence.

And so today we have an aroused public clamoring for leadership in meeting the problems of water-pollution control. And the burden is on the sanitary engineer to measure up to this challenge. Tempting

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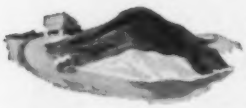

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as it is at this point to conclude with a clarion call for the profession to exercise "boldness and imagination" in meeting the challenge, candor compels something a little more earthy, such as: Let's do the obvious.

Engineering Notes

Cost of Laying Water Pipe

The 106th annual report of the Water Bureau of the Hartford, Conn., Metropolitan District Commission (work on the water supply began in 1853) gives cost data on water main construction for 1959. The cost for 846.6 ft. of 6-in. pipe laid in walk area and through private property was $8.433 per foot; 6-inch pipe laid in 1955 cost $6.050 per foot and that laid in 1950 cost $3.756 per foot. The cost per foot for 12,930.6 ft. of 8-in. pipe was for 1959, $6.436; for 1955, the cost per foot was $5.046 and for 1950 it was $4.360. For 12-inch pipe, of which 21,371.3 ft. were laid in 1959, the cost per foot was $7.0203; for comparison, 1955 and 1950 costs were $6.995 and $6.480. For the 4,449.5 ft. of 16-inch pipe laid in 1959, the cost was $12.260 per foot; comparable costs for 1955 and 1950 were $10.697 and $9.456. The footages of the various sizes laid in 1955 and 1950 are not available.

Great Lakes Basin-Illinois Waterway Antipollution Survey

A six-year antipollution study of the United States portion of the Great Lakes Basin-Illinois waterway has been started by the Division of Water Supply and Pollution Control of the Public Health Service. A Congressional appropriation of $500,000 for the first year will be used for an inventory of all points of inflow into the Chicago River and connecting waterways, measurement and analysis of municipal and industrial wastes discharged and determination of the effects of such discharges under various conditions of flow. A 40-man staff will be located in Chicago under the directorship of William Q. Kehr.

Agadir Earthquake and the Water Supply

Following the disastrous earthquake at Agadir, Morocco, last spring, an examination of the water supply system was made by officers of the CEC, USN. The water distribution system in the central part of the city was destroyed, many mains having been broken. The two wells which provide the city with water were not seriously damaged, and some of the pumps and the chlorinating equipment were found in working order though the pump house was badly damaged. By closing off the broken mains, safe water could be delivered to portions of the city where mains were not badly damaged; and temporary lines were laid to serve other areas.

Lightweight Brick

Recent experiments by the Structural Clay Products Research Foundation have developed a lightweight clay aggregate which, when mixed with regular clay and made into brick, results in a brick nearly 40 per cent lighter while providing sufficient strength for construction.

FORECAST:
Heavy rains for next 24 hours

Will you be deluged with calls about flooded streets and property?

You'll hear few complaints ... if you handle drainage problems the way Deuel County, Nebraska, does. Deuel County *avoids* the problems with a continuing drainage-correction program. And a key tool in the program is the County's big, fast LW POWER-*Flow*® 550 grader.

This 145-hp grader, equipped with torque converter, drives to trouble areas at speeds up to 26.4 mph. Here, corrective measures may require the "550" to clean drainage ditches ... dig new ones ... or regrade a section of road, as was the case in the job pictured below. Whatever the grader job ... be it tough construction or maintenance ... Deuel County's POWER-*Flow* 550 completes them at top efficiency.

"Has no comparison for power and maneuverability"

Deuel County officials are enthusiastic about their LW 550. Says County Commissioner Allen Southard, "This grader is the best we've ever had ... it has no comparison for power and maneuverability. It has everything we will ever need in a grader!" Adds Ariel H. Clark, a veteran grader operator of over 37 years, "This '550' will do anything we ask of it ... and it will do the job *right* ... and *fast*."

Taxpayers' dollars go further when you handle road-maintenance and construction jobs with modern LW graders. These graders have the high speeds and work advantages that let them complete *more* work faster than any comparable grader. Let us prove our claims with a demonstration of any one of the 7 LeTourneau-Westinghouse models, 85 to 190 hp. Ask for free grader bulletin, "More for Your Money".

A drainage-correction job recently handled by Deuel County's POWER-*Flow* 550 at Big Springs, Nebraska, required regrading 170 ft. of street so water run-off will not flood private property. Here operator Ariel H. Clark strips excess material into a windrow for easy removal by the County's LW D Tournapull® scraper.

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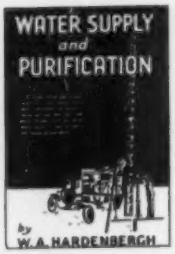

Water Supply and Purification

By W. A. Hardenbergh

Among the major changes introduced in this latest edition are the following: The chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up-to-date; and a new chapter has been added on fluoridation. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle C-1 on the coupon.

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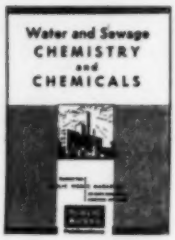
Water and Sewage Chemistry and Chemicals



If you are not an expert chemist but want a dependable text on chemistry as applied to sewerage and water works—send for this valuable reprint today. Written in plain language so anyone can understand it. Four color illustrations are used to show the exact nature of colorimetric reaction in some specific laboratory tests—something that is possible only with this type of work. Of special interest to water or sewage plant operators. To order your copy just circle number C-2 on the handy coupon.

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Principles of Soil Engineering

By Robert F. Baker

A knowledge of soils and soil engineering is important for all who deal with earth for engineering problems. Rarely is a structural design evaluated without recognition of the soil characteristics affecting foundation requirements. Without attempting to develop detailed concepts and procedures, Professor Baker has presented a comprehensive discussion of the subject of soil behavior in terms of basic principles. To order your copy of this informative 40 page booklet just circle number C-3.

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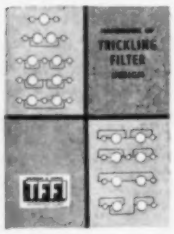
Handbook of Trickling Filter Design



This is the fourth edition of this informative and valuable 38 page Handbook. It has been completely revised, rewritten and brought up to date. Among the many subjects included are General Design, Media, Drainage and Ventilation, The Aerofilter: Description and Design Data, Standard Rate Filters, General Design for High Rate Filters, The Biofiltration System, The Accelo-Filter System of Wastes Treatment, A Nomographic Solution for Trickling Filter Design. Just circle number C-4 on the coupon.

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The Design of Small Water Systems

By Joseph A. Salvato, Jr., P.E.

Water systems to serve small communities, institutions, camps, turnpike service areas and isolated commercial establishments present special problems for the designer. In this excellent 28 page reprint the author considers design standards, equipment, filtration, sources and treatment, quality problems, pumping distribution, coagulation and settling, operation control, storage and related factors for systems capable of supplying 15,000 to 200,000 gallons per day. Just circle number C-5 for your copy.

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Sewerage and Sewage Treatment

By W. A. Hardenbergh

An authoritative yet simple treatment of the subject by one of the nation's foremost authorities. Mr. Hardenbergh's editorial and field work has brought him in close contact with the problems that trouble the average engineer and in this book he explains those methods most suitable for general use. Special attention is paid to sewerage systems, both storm and sanitary. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods. To order your copy circle C-6 on the coupon.

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The Operation of Sewage Treatment Plants

This valuable text has been completely revised, expanded and brought up to date. In it all phases of Sewage Treatment Plant operation are treated in simple, easily understandable language. Among the many subjects covered are: measurement flow; concentration and temperature; sampling sewage for analysis; laboratory determinations; purposes of treatment; operation of grit chambers; operation of screens; trickling filter operation; filter fly control; disposal of sludge; etc. Circle C-7 for your copy.

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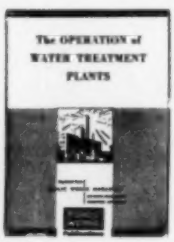
The Operation of Water Treatment Plants



Here in one place you have the basic information concerning all phases of plant operation. Even those without previous technical school education will find it easy to learn from this valuable text. Completely revised, expanded and brought up to date by Clayton H. Billings, Associate Editor of Public Works. This reprint is of special interest to Water Works Superintendents, Water Treatment Plant Operators and everyone connected with the Water Works field. To order your copy circle C-8 on the coupon.

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Every hand involves some basic principle of good poker playing. Simple rules, but ones which are most often violated by most good losers. Of course, following the rules is no guarantee you'll win. But, you should win more often.

Ford is not recommending that you gamble. But if you do play poker for money, chalk or marbles... or for that matter, just for the fun of it, you'll probably enjoy the game even more when winning.

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Next month, for instance, we'll announce a cash-money offer which so far as we know has never before been made in this field. Watch for it. It could be worth more to you... well, maybe more... than a royal flush!

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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Claim for Additional Compensation by Contractor

Walla Walla Port Distr.ct v. Paimberg, 280 F. 2d 237, a State of Washington case decided by the United Sta.es Court of Appeals on June 13, 1960, was an action by a dredging contractor against a municipal corporation for additional compensation.

In its engineering specifications for a dredging contract at the site of the flooded town of Attalia, Washington, the municipal corporation stated that the material to be dredged was anticipated to be sand, silt and fine gravel. Upon inquiry by plaintiff of the consulting engineer for the municipal corporation, the consulting engineer failed to disclose to him knowledge and information relating to the presence of rocks and boulders.

Plaintiff submitted the low bid and was awarded the contract. After commencing performance of the contract, he encountered difficulty in dredging operations because of the presence of cobbles and boulders, an asphalt paved roadway running through the area to be dredged, trees, telephone poles which had been cut off below water level, fence posts, wire, etc. Plaintiff claimed extra compensation because of these difficulties.

The court held that, under Washington law, the contractor was entitled to rely on the implied representation of the municipal corporation that it had fully disclosed to the contractor all relevant information in its possession concerning subsoil conditions. The court therefore allowed the contractor's additional claim of $33,920.

Removal of Snow and Ice

Hartley v. Tacoma School District No. 10, 354 P. 2d 897, a State of Washington case decided August 18, 1960, was an action by a pedestrian against the city for personal injuries suffered when the pedestrian fell on an ice and snow-covered sidewalk in front of the entrance to the school, on an arterial street, near the shopping area.

An ordinance required the school district to clear the sidewalks crossing its property. The court held that the city was entitled to wait a reasonable time to see whether the school district would remove the snow and ice, before the burden was cast on the city to remove it within a reasonable time. However, it was proper for the jury to find as they did that the city had had sufficient time between the last snowfall (which occurred on a Tuesday) and the time of the injury (the following Monday).

The judgment in favor of the pedestrian was therefore affirmed.

Competitive Bidding

Armaniaco v. Borough of Cresskill, 163 A. 2d 379, a New Jersey case decided July 11, 1960, was an action by a taxpayer to set aside a resolution of the borough awarding a construction contract with respect to a section of the municipal sewer system.

The specifications required each bidder to submit unit price bids on 34 of the 35 items involved in the work to be done. The quantities required for the items were estimated in the specifications. The total price, computed by multiplying the estimated quantities by the unit price bid, formed the basis for a comparison to determine the low bidder. The "Information for Bidders" provided, "Any bid which, in the opinion of the Engineer, is obviously unbalanced, may be rejected."

The bids by Stamato included certain items which were bid at clearly nominal prices. He was the low bidder, and the next lowest bidder protested. However, since it is settled that an unsuccessful bidder has no standing to attack the specifications, this protest was dropped.

The plaintiff in the present case, a taxpayer, attacked the validity of the award of the contract on the ground that Stamato's nominal bids constituted unbalanced bidding. It was conceded that there was no fraud or collusion between Stamato and any of the borough officials.

The court pointed out that an unbalanced unit price bid (i.e. where one or more of the items does not carry its share of the cost of the work and the contractor's profit) are susceptible of fraud and collusion (in case the estimates in the specification are intentionally inaccurate). It also carries the additional danger that the successful bidder can take his profit out of his early payments on the job and fail to complete the items on which he made nominal bids. The court held, however, that unbalanced bidding does not in itself invalidate a bid or a contract let under it, unless the specifications so provide.

In the present case, the Engineer may have had a right to reject the bid because of unbalanced bidding, but he was not required to do so. And since there was no actual fraud or collusion, the award of the contract was not illegal on this ground.

The court held, however, that a fixed price of $42,000 set in the specifications for rock excavation was invalid, even though it was practically impossible to determine the amount required to be removed. Such an important item must be subjected to competitive bidding.

• • •

Conference on Parking

A conference on parking will be held at Georgia Tech., Atlanta, Georgia, May 18-19. This will be sponsored by the School of Civil Engineering and conducted by the Department of Short Courses and Conferences, Georgia Institute of Technology. Further information from Director of Short Courses and Conferences, Georgia Tech, Atlanta 13, Georgia.

Road and Street Mileage in South Dakota

There are 92,907 miles of roads and streets in South Dakota. Of these, 89,412 miles are rural roads and 2,685 miles are city streets. Of the city streets, 224 miles are a part of the State Trunk system and 276 miles are extensions of local roads. The State Trunk system totals 7,256 miles; the County highway system 20,316 miles; and the Township system 43,700.

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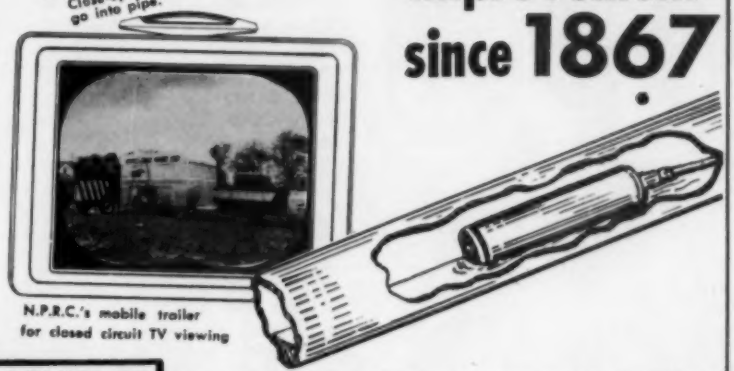

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This cut-away view of a pipe shows how the camera is dragged by a 1000-foot steel rod through a leaking section of sewer or water pipe. When a leak shows up on the TV screen, the operating technician stops the camera and pinpoints the exact location of the leak.

WHAT CAN IT DO?

★ Go through a pipe as small as 4"
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★ Save you hundreds of man hours
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One city, with an especially bad stretch of sewer pipe, paid less than $2,500 for repairs after inspecting their system by closed circuit TV. Bids for locating and fixing the leaks through standard methods ran above $200,000.
Savings: $197,500

Another city had problems when a series of new sewers started to spring leaks. If they had been forced to tear up the streets to find and seal the leaks, the total cost would have been nearly $250,000. Actual cost, through the closed circuit TV system . . . less than $35,000.
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City of Binghamton sees clear water ahead for a full generation

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Present population: 85,000—growth reaching at least 105,000 by 1975. This is the future for Binghamton, booming city in upstate New York. With this fact in mind, planning of their new 4,000,000-dollar filtration plant accented expandability for rapidly increasing water demands to 1990.

Westinghouse has provided a power distribution system that will assure this objective. With present pumps and treating equipment, total capacity is 31,000,000 gallons per day. Plant capacity can be expanded 50% during the 30-year period without additional substation, bus or switchgear equipment. Beyond basic flexibility, the electrical equipment will be called upon for absolute, 24-hour reliability for this projected long life span. Westinghouse power components are coordinated to work together, and will fulfill this objective also . . . dependability, with minimum servicing or maintenance.

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2. Strength, beauty and simple utility . . . Plant exterior is finished in blue glazed brick, yellow porcelain enameled steel panels, anodized aluminum trim.

3. Utilized plant control . . . Main distribution center for new plant provides power to motor and auxiliary feeder circuits. Fed by 4000-ampere ventilated low-impedance bus duct, board consists of (right to left) plant service transformer and power panels; 480-volt switchboard with incoming line and motor feeder breakers of reliable DB design; control panels including flow and pressure indicators, gauges and master indicating lights to show status of all plant operating equipment. Entire unit was assembled by Westinghouse and delivered complete and prewired for fast, easy installation.

4. Mr. G. E. Rickard, Water Superintendent, checks ammeter reading at incoming switchgear and master control board with Mr. R. C. McNamara, City Engineer, who supervised over-all construction project.

5. Dependable power for 30 years . . . G. E. Rickard and R. D. Batley, Westinghouse Sales Engineer, discuss one of three Westinghouse SL transformers in plant outdoor substation. Present bank capacity is 2500 kva—future uprating to 2875 kva is possible through provisions for addition of forced air cooling. Westinghouse transformers feature exclusive Insuldur® insulation and Hipersil® grain-oriented steel cores to give extended life and higher efficiency. This substation, furnished by Westinghouse, also includes: 15-kv, 600-ampere, 100,000-kva IC oil circuit breakers; Type V disconnect switches; Type S station service transformer; main low-voltage bus as well as the integrated steel structure.

2

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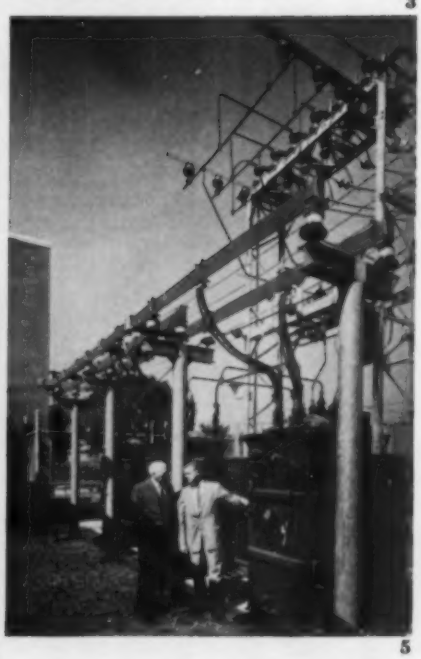

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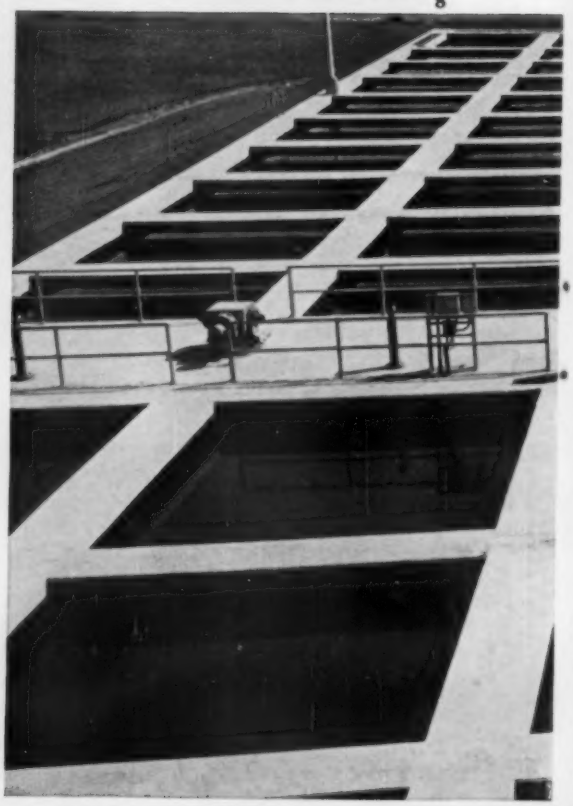


10

J-94152-3

Filtration Plant Powers-Up for Next 30 Years

(cont'd)

OWNER: *City of Binghamton*
GENERAL CONTRACTOR: *Smith-Howard and Sprague, Binghamton, N. Y.*
ELECTRICAL CONTRACTOR: *Lord Electric Co., Inc., New York, N. Y.*
CONSULTING ENGINEERS: *Leonard S. Wegman Co., New York, N. Y.*
Alexander Potter Associates, New York, N. Y.
ELECTRICAL DISTRIBUTOR: *Westinghouse Electric Supply Co., Long Island City, N. Y.*

6. Compact, expandable motor control . . . These Westinghouse units, together with the lighting panelboard (door open), centralize control for all auxiliary equipment in the chemical building. Motor starters serve mixers, drives, pumps. Thirty-kva transformer, feeding panelboard, completes assembly. Blank sections, at left, permit future additions.

7. Control for added capacity . . . Starters for high lift pumps include two new Westinghouse reduced voltage autotransformer types to complement several starters moved from original plant. Control accessories were added to modernize these—thus providing an economical conversion to the new control scheme. Westinghouse starters were used to control new 600-hp high lift pump and 125-hp wash water pump.

8. Close cooperation among the consulting engineer, electrical contractor and Westinghouse makes it possible for Binghamton to provide for the future today. Seen at left: A. J. Juris and E. J. Young of Lord Electric Co.; E. Piller, Westinghouse Electric Supply Co.; P. J. Gallagher, Westinghouse; and J. J. Fenley of Lord.

9. Color and light welcome visitors . . . Lobby area is handsome with terrazzo flooring, marble paneling, mosaic tile stair wells. Westinghouse Mainliner fluorescent luminaries blend with building's structural elements. Average illumination intensity is 90 foot-candles.

10. Room for more . . . C. E. Ahern, filter operator, seen at Westinghouse NLAB lighting panelboard which contains normal and emergency breaker sections with spares for future circuits. Flush trim and special brass hinges harmonize with architectural detail of plant.

11. Take water, add chemicals, mix well . . . G. E. Rickard and R. D. Batley inspect the slow mix tanks. Settling tanks in background provide 3½-hour detention. Entire area is illuminated at night to promote safe operation and permit 24-hour observation of flocculation process.

J-94152-4

Westinghouse

In closing months, 99 trucks ran night and day over five test loops to pile up 17 million miles

It's the great NATIONAL ROAD TEST!

November 30th, test traffic ended in $27,000,000 pavement test sponsored by the American Association of State Highway Officials (AASHO).

More than 1,100,000 load applications and millions of scientific readings were recorded before the last truck rolled off the track near Ottawa, Illinois. The fleet of trucks included farm-size pickups to 54-ton semi-trailers.

On the test loops, 836 separate sections repeated nearly 200 different pavement combinations to provide a wide range of measurements.

Behind this pavement test are the most scientific methods ever used. Automatic electronic instrumentation and recording equipment assure unbiased, reliable findings.

Administered by the Highway Research Board of the National Academy of Sciences—National Research Council, the National Road Test will answer the big questions in today's highway construction. Engineers, officials and legislators will have invaluable help in designing pavements for the Interstate System—and all roads and streets.

Scientific readings by the millions have been analyzed by AASHO computers. "Statistically unassailable" facts on modern pavement design will result.

PORTLAND CEMENT ASSOCIATION

A national organization to improve and extend the uses of concrete

PUBLIC WORKS MAGAZINE • VOLUME 92, NUMBER 1, JANUARY, 1961

WHAT IS THE FUTURE OF METROPOLITAN TRANSPORTATION?

E. H. HARLOW
Vice President
Frederic R. Harris, Consulting Engineers
New York, New York

THE PRESENT chaotic situation of transportation in our metropolitan areas began with the use of devices invented by man and the abandonment of the creations of nature. For moving people about, these devices are essentially: Railroads; private automobiles; buses; transit vehicles; and airplanes.

Originally, each of these devices was designed to move *people*. Much of our present day planning has degenerated into schemes for moving *vehicles*. The distinction is a vital one. For basic purposes, the function of each system has grown more or less as follows:

The Railroads, built upon lands granted by state or federal governments under franchise, were privately financed and operated. Their income, derived from the fares and charges for hauling passengers and freight, has been supplemented by other-purpose leases of the lands held, but has been subject to taxes by the municipalities and states. Railroad capital must show a return of profit to the owners and shareholders if the system is to survive; circumscribed by Federal regulation as public utilities and limited by complex union contracts, the railroads today find the process of change a cumbersome business with staggering obstacles.

The Private Automobile, successor to the horse and carriage, starting as the rich man's toy and developing into the universal magic carpet, is fully dependent on the public highway system, built with money from gasoline and general taxes in the public interest.

The Bus, corollary to the automobile, is also dependent on the public highway system. Bus line franchises to private companies or to municipal agencies are generally expected to show a profit from fares, but contribute toward right-of-way only to the extent of licensing fees and gas taxes.

The Transit Vehicle, sometimes privately owned but more commonly publicly owned and operated, is a captive of the system of rails, subways, elevated structures or public streets provided generally at public expense along specific routes that cannot readily be changed.

The Airplane, which is shrinking time and space at a rate unmatched

Sketches courtesy General Dynamics Corporation

● **THE ULTIMATE** in compact cars might be an air-floated platform, 4-ft. wide and 6-ft. long, seating two people. With such a vehicle, roadway capacities would be increased, pavement costs reduced and maneuverability for parking improved.

by any previous conveyance, must still be served by ground terminals using other forms of transportation.

Each of these systems has grown independently, according to our free enterprise motives for profit-making, but with government sponsorship widely varying in extent and with the fetters of regulation and control vastly different.

The Changing Travel Pattern

The growth of the city was given direction first by the railroads in an age when the largest number of passenger-miles were carried on shoe leather. Development occurred along the radiating railroad lines, which brought not only fast travel but the transport of freight, as well. This auxiliary use soon overtook in importance the carrying of passengers, which became less profitable as competition from other forms of travel increased.

With industrialization, suburbs grew larger, industry diffused in the middle-core areas, and in most cities a public transit system was needed to carry the increasing volumes of daily commuters and shoppers. Most of the travel was still essentially radial.

The public highway system, following the most-travelled routes between and through towns, grew both radially and tangentially, with an intersecting pattern of spreading and merging suburbs. The availability of this expanding highway network started the breakdown of the relatively systematic radial pattern of expansion and travel first set by the railroads.

Now we have the emergence of the present day situation, with a new heterogeneous pattern stimulated by the personal vehicle on the public road superimposed on the skeletal remains of the older radial geometry. So we find nearly as many people heading out of the city in the morning as into it, and even larger numbers moving in diverse directions from suburb to suburb, even completely across the heart of the city. With the mobility of the private car, there is also an increasing trend toward off-peak hour travel. Nevertheless, the grand rush morning and evening, continues to exceed by 3 to 10 times the travel at other hours.

The Place of Rapid Transit

Can the mass-carrier system be revived to mitigate the transportations crisis? Obviously, it has limitations: 1) It cannot carry people from everywhere to everywhere, as does the automobile; 2) it must pick up and unload passengers at certain specific places; 3) it must operate on a schedule; and 4) for economy, it must serve a fairly large number of people.

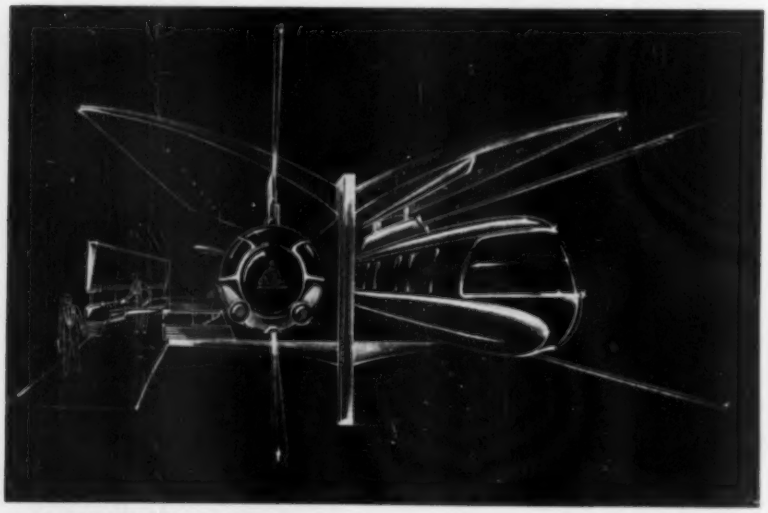
The first limitation means that mass transit cannot substitute for the automobile everywhere—only possibly on certain routes. The second requires the selection of convenient stations to serve the most people, and the stations must provide means for transfer to other conveyances. The third means that the timing of the vehicle trips and vehicle capacity must be tailored to match the travel desires of the people served.

Now take a look at the travel habits of the people in any metropolis. It is apparent that there are certain travel lines carrying far heavier loads than others. These are the routes, then, that transit may serve. The advantage offered by a modern transit system is its ability to carry widely varying loads over a relatively small strip of land and at higher speeds over short distances than any other mode of travel. For economy of operation, the average distance between stations is considerably less than for the airplane or railroad but more than for the bus.

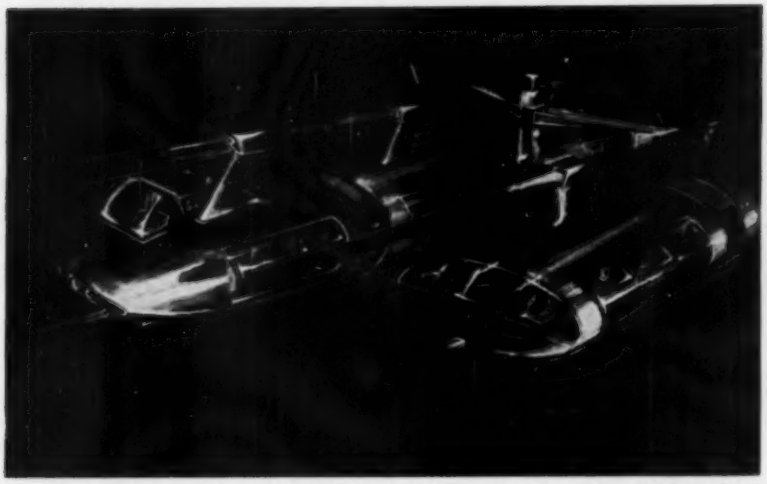
With such a system come a number of benefits. First is the relief of the staggering peak-hour traffic burden on the highways, which can never handle the situation alone. Second is the channelized travel pattern for an orderly development of the metropolis, a function similar to that of the veins and arteries in a living creature. For a city is in truth a living thing, and its growth process should be an orderly one. The transportation system provides the principal channels for its nourishment. These channels then allow systematic growth without the chaotic cross currents fostered by undirected flow of vehicles. Transportation is a regenerative business; it has a feed-back characteristic in that the kind and location of the transport arteries will, in themselves, influence the nature and growth of the area they are designed to serve.

The kind of transit system that will best meet a city's needs will vary with the particular metropolitan area, its inheritance of present transit facilities, its highways and railroads, its suburban population distribution and trends, and with its topography. A city with a well-developed rail network may find it economic to exploit such an asset to the fullest and to channel as many persons through these existing rights-of-way as possible. One with many wide boulevards and expressways might save millions by using the center islands or shoulder slopes for a new and radically advanced system based on the guided support principle.

The influence of topography on suburban and industrial development of a community is very marked; generally the same influences will control the location and nature of the ideal transit system. For example, contrast New York or San Francisco and their islands and peninsulas, hemmed in by bodies of water, cliffs and hills, with the kind of development on the flat expanses of cities like Chicago.



● **PASSENGER STATIONS** for the future mass transit system could have spots marked along platform to show loading positions when the rail cars are stopped.



● **HIGH-SPEED mass-transit vehicles of the future might consist of light, aircraft-weight cars sliding on an air film over a lower and upper steel guide rail system.**

Therefore, it is not enough to idealize the perfect metropolitan creature and say that a monorail system, for instance, is the universal answer. One must start with a metropolis distorted by geography, history and chance, study its living components and how they can grow best and then fit a suitable transport system into the teeming expanse in a way that will serve it well.

Newer Devices for Mass Transit

The kinds of vehicles that can be fitted into such a pattern are many, some old and some still untried: 1) The bus, on public thoroughfares; 2) the bus, on separate right-of-way; 3) the high-speed trolley; 4) the diesel-electric rail car; 5) the rail-bus, a hybrid of (1) and (4); 6) the electric car with third rail or overhead power; 7) the air-supported vehicle, carried on an air film over a rail system; 8) the monorail with suspended car; 9) the monorail with supported car; and 10) the ducted fan vehicle, or air car.

The best type of vehicle for a given need is a matter of individual opinion, as well as of engineering. No one variety will suit all needs. However, wherever a completely new system is practical and economical for mass transit at high speed, attention is being drawn to the seventh item in the above list, which has been suggested to The San Francisco Bay Area Rapid Transit District and its advisors. This system would consist of light, aircraft-weight vehicles sliding on upper and lower guide rails. The weight would be carried on the lower box-like rail, under the center of gravity, with a light guide rail for lateral stability directly above the cars. The cars would be without wheels, sliding on thin films of air maintained under pressure between a series of shoes, or skis, and the steel rail surfaces.

Propulsion would be by air jet or, better and quieter, by a magnetic field in the lower, supporting rail, moving ahead in a manner to propel the sliding shoes. The principle is the same as that which operates a solenoid. This latter propulsion system would be fully automatic, eliminating all noise and exhaust fumes, and would make possible a controlled acceleration and deceleration of the cars unaffected by the temperament or skill of the operator who would sit at over-ride controls in the front of the car or train only for emergency operation.

This feature of controlled speed is of surpassing importance, since it would permit fast schedules beyond present consideration. Passenger comfort is affected by acceleration, which governs the force acting upon one's body. More important still, it is affected by the rate of change in this force, or the rate of change of acceleration (the third derivative of the distance vs. time relation), which governs the rate at which a standing rider must keep shifting his weight as a car starts forward or slows down to a stop. By regulating this rate, it will be possible to achieve, with comfort, accelerations and velocities that on today's surface vehicles are quite impractical.

Even the few inevitable standing passengers would soon adjust to the high accelerations because the rate would be smooth and consistent for every start and stop. On turns, the lateral inclination of the cars would always be perfectly adjusted to the speed and degree of curvature by the refined and superior control made possible by the upper guide rail system. It has been proven and demonstrated that such a system of guidance at points diametrically opposite the center of gravity will provide a smoother ride than any other, with less secondary motion caused by any slight irregularity of the guides.

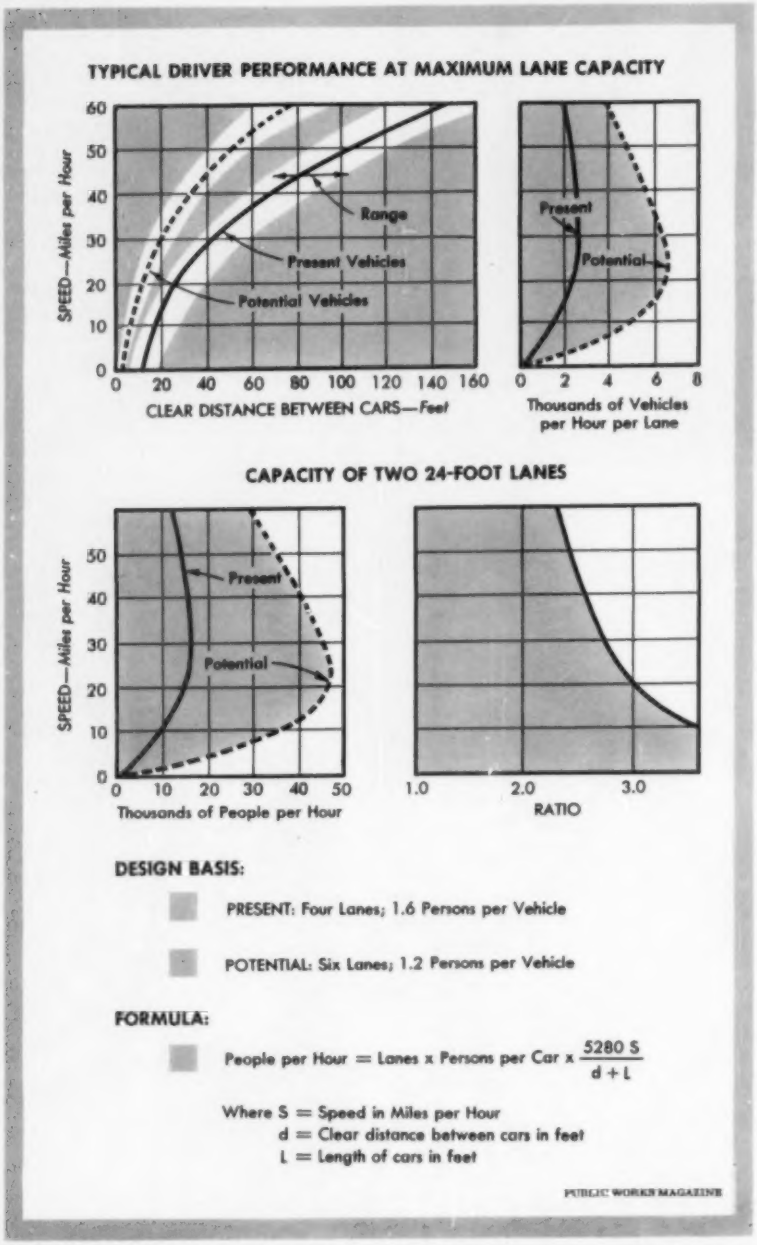
The passenger spaces would consist of European-type compartments, with both forward and rear-facing seats and sliding doors on both sides of the cars to each compartment. A narrow aisle would separate the rows of compartments on each side and provide access between them. The schedules and capacities of cars and trains would be predicated on nearly all passengers being seated in comfort, as they deserve to be.

To aid rapid loading and unloading at stations, cars would always stop at marked spots along the double platforms so that passengers could anticipate the locations of the many doors when the cars stop. Small lights above each door would indicate those compartments that have unoccupied seats and similar lights would be provided along the interior aisles.

Newer Devices for Private Transportation

Another development is the small car. By this term is meant the ultimate in single or possibly two-passenger vehicles in the trend we are now witnessing. The forces causing this steady increase in the sale of small or "compact" cars are inexorable. As vehicle crowding on the thoroughfares of the nation increases, the result is necessarily the use of smaller vehicles that will allow a better density of human occupancy of the vast expanses of pavement spreading over the land.

It is startling to think that the present density of people on a busy expressway at rush hour is no better than one person for every 2,000 sq. ft. of right-of-way. Another way of putting it would be to say that if the expressway cost $5 million per mile (in some urban areas it may cost five times that), then each person sits in solid comfort on his private, wheeled divan on a piece of public property worth about $14,000. No wonder that the laws of economics as well as the desire for better transportation are bound to


TYPICAL DRIVER PERFORMANCE AT MAXIMUM LANE CAPACITY
SPEED—Miles per Hour
Range
Present Vehicles
Potential Vehicles
CLEAR DISTANCE BETWEEN CARS—Feet
Present
Potential
Thousands of Vehicles per Hour per Lane
CAPACITY OF TWO 24-FOOT LANES
Present
Potential
Thousands of People per Hour
RATIO
DESIGN BASIS:
PRESENT: Four Lanes; 1.6 Persons per Vehicle
POTENTIAL: Six Lanes; 1.2 Persons per Vehicle
FORMULA:
People per Hour = Lanes x Persons per Car x 5280 S / d + L
Where S = Speed in Miles per Hour
d = Clear distance between cars in feet
L = Length of cars in feet
PUBLIC WORKS MAGAZINE

● **RELATIONSHIP, for various speeds, of vehicle spacing and passenger capacity for conventional vehicles and small vehicles designed for contact without damage.**

bring about a better use of public space and money. We see this happening in America every day in the form of more tiny cars, motor scooters and other small vehicles.

However, it may be that what we see now are merely awkward adaptations of older types of vehicles, in the same sense that early locomotives looked like stationary steam engines on wheels. Thus, today, the bicycle is changing into the scooter and the big, six-passenger, cross-country car has a small brother. But for urban use what would the ideal vehicle be?

It might be an air-floated platform, 4-ft. wide and 6-ft. long, having a seat big enough for two at most, with a small compartment in front of the foot-space for purchases at the local shopping center. The upper half would, of course, be enclosed with a transparent removable hood, providing air-conditioned protection from the weather. It might even be wheel-less propelled by a large ducted fan beneath the passengers; the shaft and motor controlled by a swivelled steering post that would allow the riders to balance above the fan with no more difficulty than a cyclist has in balancing on two wheels.

Such a vehicle would treble the capacity of a present-day expressway. A four-lane expressway today, with every car going 50 mph and spaced five car-lengths apart, would handle about 14,000 people per hour. The same expressway, with three lanes of these small vehicles instead of two in each direction, and with each car going only 30 mph and three car-lengths apart, would handle about 46,000 people per hour.

The small vehicle would also permit more economic designs to further increase the use of public-right-of-way. For example, our Federal Interstate standards for expressway design require wide shoulders and extra space on either side of the pavement to accommodate the gargantuan passenger vehicles, as well as the trucks. Much of this extra space could be used for more lanes for actual travel. Furthermore, whereas pavements and bridges must now be designed for heavy concentrated wheel loads, a lighter, air-supported vehicle would only require design for the smaller vehicle load weight distributed over its entire base area. Substantial savings in the cost per mile of roadway would result.

Whatever form future vehicles may take, two things appear certain: There is a continuing need for individual transportation vehicles in America and there is an urgent need for improved mass transportation facilities in the big metropolitan area.

• • •

Street Inventory Discloses Needs for 20-Year Period

A major project which was completed by the Public Works Dept. of Adrian, Mich., during the past fiscal year was the street inventory analysis. Based on anticipated needs for a twenty-year period, the study related the present condition of streets, curbs and gutters and bridges to those future needs. From this study, it will be possible to formulate plans for the next twenty years to insure that the city streets are maintained at prescribed standards. The majority of the work will be maintaining or widening existing streets; construction of only two new streets is foreseen at present. On the basis of the analysis, it appears that at least $4 million will be required in the next twenty years to carry out an adequate program.

● ORSANCO robot monitor has transmitter at top, analyzer modules in center and flow cells at bottom.

● CENTRAL OFFICE houses the telemeter-receiver. Signals can be registered on a strip-chart recorder, a tabulator or by punched tape.

ROBOT MONITOR

Keeps Watch on River Conditions

EDWARD J. CLEARY
Executive Director and Chief Engineer,
and
WILLIAM L. KLEIN
Chemist-Biologist,
Ohio River Valley Water Sanitation Commission,
Cincinnati, Ohio

Presented at a Symposium on Water-Quality Measurement and Instrumentation at the Robert A. Taft Sanitary Engineering Center.

SEVERAL years ago in an annual report, the Ohio River Valley Water Sanitation Commission stated it was imagineering a robot monitor to improve its system of river surveillance. This aspiration is on the eve of realization. Components of the system are completed and there is reason to believe that rivers in the Ohio Valley will be the first in the world to be under continuous, automatic surveillance for quality control.

Components of the Orsanco robot system have been under development and test for some three years. But the river monitor and surveillance program of which it forms part had its beginnings in 1951. At that time Orsanco pioneered the concept in pollution-control practice of establishing observation stations for systematic checking of quality and reporting of unusual conditions.

The present network of 43 manually-operated stations has had an important role in securing more effective pollution control but it has left something to be desired. Water sampling and analysis are time-consuming procedures; and it was not practical, of course, to maintain patrol on a 24-hour around-the-clock basis. These and other considerations stimulated exploration of automatic devices to maintain constant vigilance on river quality.

This exploration program was formally organized with these objectives: Determine the availability and applicability of analytical instruments that might be adapted to river monitoring; conduct operating tests and undertake the design of equipment whose features would incorporate the reliability required in unattended locations; and evaluate the application of telemetering devices and methods for data-logging.

From the more than 50 instrument companies who were contacted during initial inquiries, only three were optimistic in terms of supplying instruments that might be suitable for automatic river-quality de-

terminations. Automatic instruments on the market were designed primarily for application to industrial product quality or process control. Many of them could perform continuous analyses; but they required daily checking and adjustment. Further, the instruments operated best with liquid or gas streams whose composition remained fairly uniform. In contrast, the medium with which we were working —river water—is subject to variations in composition and, in addition, carries suspended material. To add more complications, we were seeking instruments that would operate with precision and without checking for at least a week and hopefully for as long as a month.

It was evident also from the responses that our inquiry suggested an unrecognized potential market for instrumentation. The concept of an automatic river-monitoring system was a new one to virtually all of the manufacturers.

Experiences and Decisions

Several promising possibilities in instruments ultimately were uncovered and placed under test. This work was facilitated through a happy arrangement with the City of Cincinnati Water Works. It was possible to locate our specially-designed trailer laboratory adjacent to the municipal water-pumping station, where a direct tap could be made to the Ohio River intake. This not only assured a continuous source of raw river water, but the water itself is routinely analyzed by city chemists every few hours and thus we had data for comparison with results from the automatic analyzers.

At the risk of over-simplification, the instruments that received our attention might be classified in two categories: One group is based on the application of photometers. The other type employs electrodes or transducers.

Instruments in the photometric group operate on principles involving measurement of the intensity of light transmission. These instruments perform either a direct measure of the concentration of a substance in a solution, or do so indirectly by measuring the effect of a chemical reaction resulting from the addition of a reagent.

Instruments of the electrode or transducer type employ sensing devices that present their information-output in the form of a varying electrical impedance or a generated voltage signal. The electrode system may consist of a pair of metallic plates, or may involve the use of permeable membranes and cells containing diffusion liquids.

The Orsanco robot monitor has been designed to use electrode and transducer-type instruments. One factor leading to this decision was the probability of monitors being located where the replenishment of reagents is not convenient.

From the array of instruments that are being tested and placed through various stages of modification, seven have been chosen thus far for incorporation in the prototype Orsanco robot monitor. These provide for the measurement of: Hydrogen-ion concentration, chloride ion, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and solar radiation. All of these instruments have been modified so that they fit into a standard-size drawer-type compartment, which we call a module. Thus, the robot monitor can be descriptively termed a "modular multiple-analyzer."

Instrument Design and Circuitry

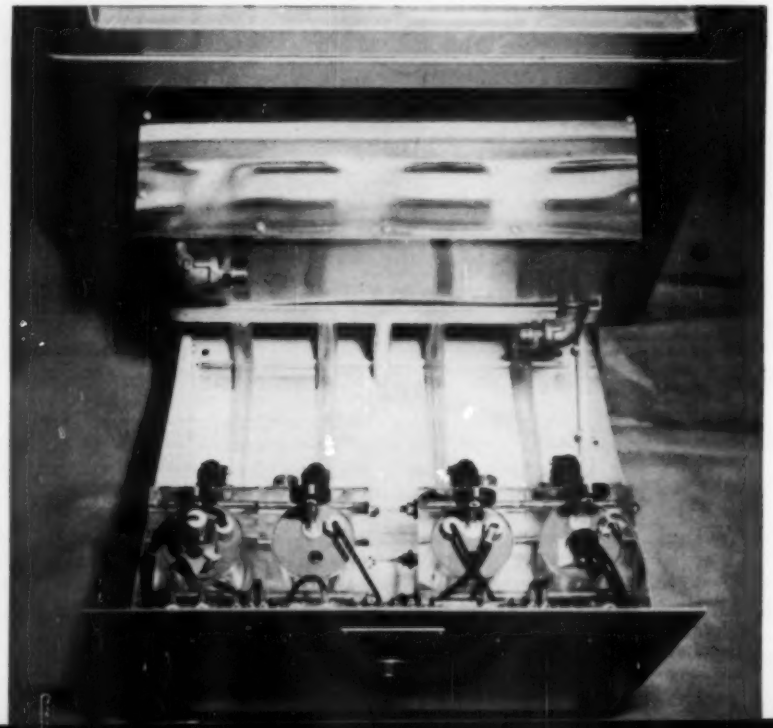
Details of the instruments are described by Carl Schneider, who serves as Orsanco's electronics consultant and who also built the equipment, in this fashion:

Three of the river-quality characteristics monitored by the prototype robot—namely, pH, oxidation-reduction potential (ORP) and chloride ion—involve the use of electrode systems which form electrolytic cells. For pH measurement a glass electrode and a reference electrode are used; for ORP determination a platinum inlay electrode is employed with a reference electrode; and for chloride-ion measurement a silver-silver chloride pressed-billet type electrode and a reference electrode are used. The pH and chloride-ion measurements require the use of an auxiliary thermo-compensator to correct automatically for temperature changes. All reference electrodes are palladium annulus reservoir-type electrodes having adequate solution capacity for long-term, unattended operation.

Two other parameters being monitored, namely, temperature and specific conductance, involve the accurate measurement of impedance. For temperature measurement a nickel resistance element enclosed in a stainless-steel bulb is used, and for conductivity an electrode consisting of a pair of platinum plates is immersed in the river water.

The monitoring of dissolved oxygen presents the problem of measuring a small current through a Carritt-Kanwisher electrode. This electrode system includes a silver-silver oxide reference electrode and a platinum indicator electrode, both of which are immersed in a 0.5N potassium hydroxide internal electrolyte. Current flow between electrodes, when a low DC potential dif-

● **FLOW-CELL** *compartment of robot monitor, at bottom of unit, contains a constant head tank and bored lucite blocks in which the electrode systems are mounted.*



ference exists between them, is a function of the amount of oxygen dissolved in the water.

For determination of solar-radiation index, solar cells are exposed on an exterior flat surface. A differential signal is processed through circuitry similar to that used for dissolved oxygen measurement with temperature compensation introduced as required.

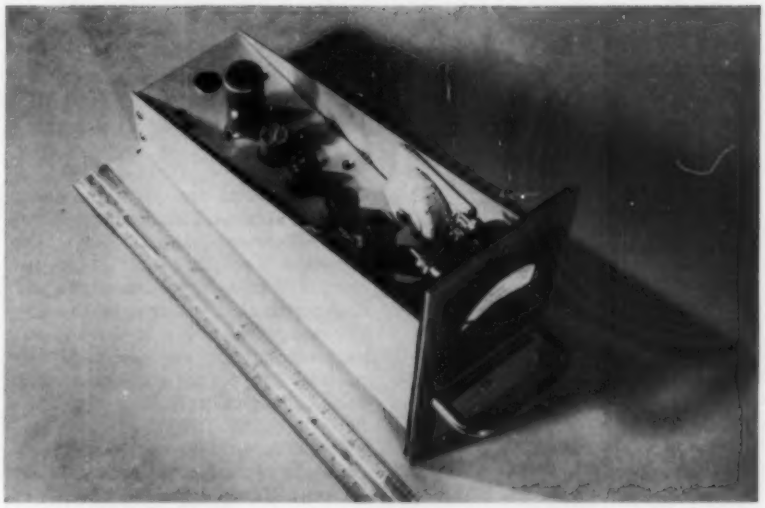
The unit is housed in a weatherproof, stainless-steel cabinet slightly smaller than a standard 66-in. rack panel cabinet, and it consists of three separate identical cubicles. These cubicles (which are 24 inches wide, 21 inches high and 21 inches deep) are designed with nesting tops and bottoms which permits stacking them without the necessity for bolting. They are fitted with recessed folding handles on the sides and individually are readily portable. The three cubicles contain, respectively: (a) the flow cells and auxiliary items, (b) the analyzers and power supplies, and (c) the telemeter transmitter.

An automatic sample-taker is incorporated in the flow-cell cubicle. This permits the storing of a quantity of river water when an abnormality of quality occurs that might warrant more detail laboratory examination.

For the transmission of information from the river monitors to the control center in Cincinnati, the Minneapolis-Honeywell Company designed and built for Orsanco a low-frequency multiplex system. It includes a telemeter receiver and an associated strip-chart for the control station, as well as a transmitting unit to be used with the analyzers at each river station.

The telemetry has been devised to interrogate up to 40 monitor stations and to record 10 variables from each station. Signals are transmitted over a Grade I intercity telegraph line, the least expensive of the wire services available for leasing. In order to take advantage of this low-cost service the system was designed with suitable electrical characteristics. It is designated as a system for operation in "½ duplex time-multiplex mode on a single loop in the 0-15 cycle per second frequency range." The cost of the service averages 75 cents per mile per month, plus a "drop charge" for each robot monitor station in the system.

At time intervals, which can be pre-determined, the Cincinnati control center will automatically interrogate each monitor station calling them in numerical sequence. Each monitor responds to its coded call and transmits signals in orderly sequence that provide data for recording the quality characteristics being measured.



● **ANALYZER module contains electronic parts and circuitry for reporting results.**

All of this information is, in turn, fed into a data-logger; the encoder of the logger is driven by the telemeter strip-chart recorder. The data-logging portion of the equipment was designed by the Datex Corporation of Monrovia, Calif., to be compatible with the telemetering system. Purpose of the data-logger is to transcribe telemetered signals from the monitors on a permanent, tabular form and also make a punched-tape recorder. The latter will permit handling the data in a computer for determination of maximum and minimum values, rate of occurrence, and other routine evaluations.

The resulting tabulation of data has been planned to provide an overall presentation of river conditions available for prompt interpretation, and which will be continuously maintained up to date. Information from each station is tabulated on a single horizontal line arranged in vertical columns for each parameter being measured. Thus the interrogation of all remote stations in sequence will provide in each column a summary of quality variations throughout the length of the river.

Some Philosophic Aspects

The surveillance and monitoring activities are yielding valuable clues for a practical assessment of the behavior of the river system and the performance of waste-control facilities. The data produced by systematic monitoring provides an unparalleled opportunity to match actual conditions against predictions based on design assumptions. This type of evaluation is needed particularly in the Ohio Valley, where stream regimen is complicated by canalization structures, as well as the operation of tributary reservoirs for flood control and low-flow augmentation.

Acknowledgments

The Orsanco Robot Monitor system is based on an original conception of the senior author whose enthusiasms have been generously supported by the commissioners of the Ohio River Valley Water Sanitation Compact. Detailed execution of the project was the responsibility of the junior author, assisted by Carl Schneider, electronics consultant to ORSANCO.

Contractors who engineered and fabricated the units are: Engineering Specialties Co. of Madeira, Ohio; Minneapolis-Honeywell Corp. of Philadelphia; and the Datex Corp. of Monrovia, Calif. Other equipment or consultation on development was furnished by Beckman Instruments Co., Hach Chemical Co., Jarrell-Ash Co., American Telephone and Telegraph Co., Industrial Instruments, Inc., Daystrom, Inc., George D. Philbrick Researches, Inc. and Met-L-Fab, Inc.

The City of Cincinnati Water Works furnished facilities for testing equipment; Dan Enright, supervisor of filtration, and Robert Doepker, chemist, were especially helpful in this phase of the work.

The project was financed from part of a federal grant made to the Commission under provisions of Public Law 660.

Traffic Committee Solves INTERSECTION PROBLEMS

WESTON E. FOLLETT

Assistant City Engineer

Oakland, California

STREET INTERSECTIONS are one of the major problems facing a department of public works. Records of traffic accidents in the City of Oakland show that 78 percent of the accidents occurred within or adjacent to intersections. Studies made by the Oakland Police and Traffic Engineering Departments also show that on city streets the accident rate is 14.15 accidents per million miles of vehicular travel; whereas, the State Division of Highways, District IV, San Francisco, reports that on full freeways, free of intersections, the rate is only 1.5 accidents per million miles of travel.

In addition to this high accident rate caused by intersections, the capacity of major city streets is also seriously affected by the flow of cross street traffic. A comparison of a freeway lane capacity of 1,500 to 2,000 cars per hour with a city street capacity of 500 to 700 cars per hour per lane forcefully points this out.

Since the Second World War, traffic volumes in the City of Oakland have increased at a greater rate than the ability to construct new street facilities. It was recognized that much could be done to increase the capacity of our present street system by special intersection treatment; to do this would require the experience, skill and knowledge of our best qualified men. In 1953, a Traffic Committee was revived at the suggestion of City Engineer John A. Morin. (This committee was originally established in 1938). The committee, which meets weekly, is composed of the experts within our organization. It consists of the city engineer, city traffic engineer, superintendent of the electrical department, street design engineer and the police captain in charge of traffic.

In 1953, this group tackled the problem of traffic congested intersections. The committee determined the locations where the accident rate and congestion were the greatest. Then the committee designed and approved a solution for each of these special intersections. During the last 6 years the committee has successfully reviewed and approved the design of over 113 intersection channelizations.

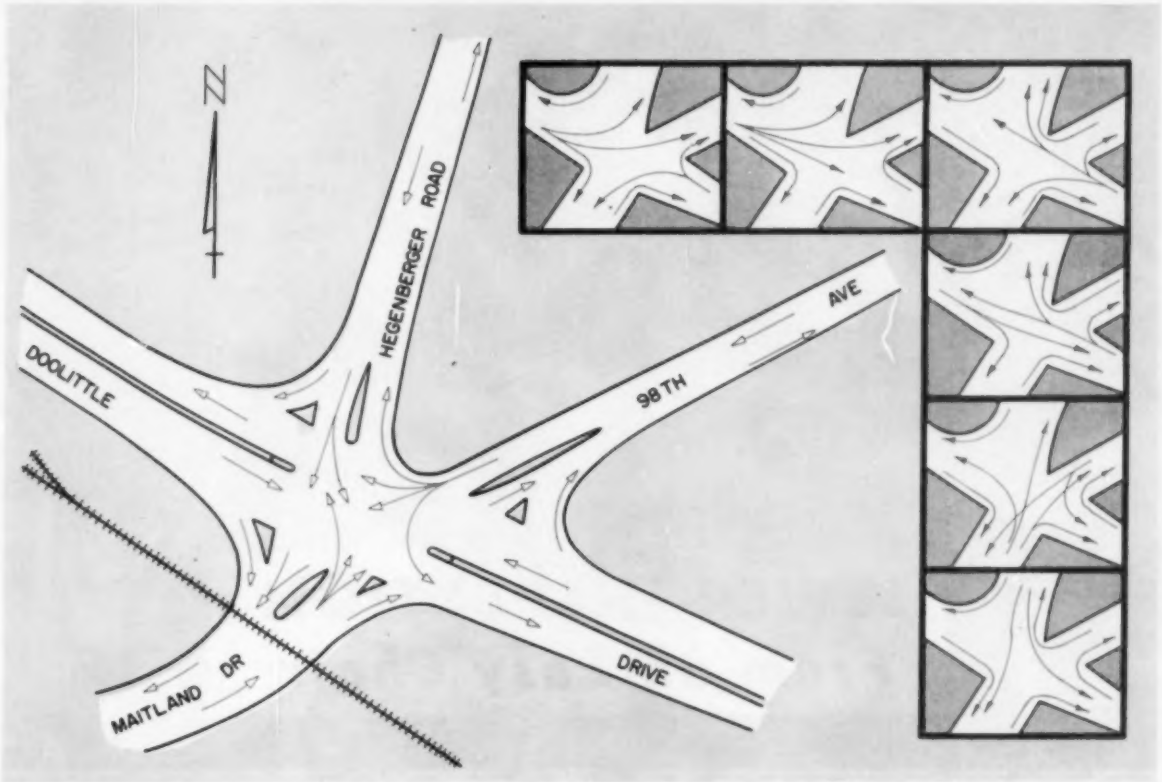
Bond Way and East 14th Street. One intersection approved by the Committee is located on East 14th Street at Bond Way and 46th Avenue. East 14th Street, a main east-west four-lane arterial street, carried in excess of 660 vehicles per hour per lane during peak hours. Due to partial completion of a city project on Bancroft Avenue, traffic on Bond Way was approaching its maximum capacity, necessitating treatment of this intersection. Had traffic volumes permitted, a three-phase signal treatment would have solved this problem; however, the loss of "green time" on East 14th Street would have reduced its capacity, making this solution impossible. To further complicate this problem, East 14th Street is a state highway, requiring state approval of any proposed construction.

As a solution, the committee proposed a center median on East 14th Street, providing a left turn lane into Bond Way, and the reconstruction of 46th Avenue southerly of East 14th Street, providing a free right turn from 46th Avenue into East 14th Street, as well as providing a direct alignment into Bond Way. A two-phase signal provided one phase for the East 14th Street movement, and the second phase for the East 14th Street left turn and north bound 46th Avenue into Bond Way. (It should be noted that the volume of traffic on 46th Avenue north of East 14th Street is negligible.) According to the rules of good design, this arrangement should not work (and State approval was obtained with considerable reluctance on their part); however, the project was constructed and has been operating successfully for over three years.

Although this writer does not advocate variance from the accepted standards of street design, experience with the treatment of existing facilities in situations where the cost of additional right of way is prohibitive, has indicated that the use of sub-standard lane widths, weaving lanes and signal installations are often justified. It is felt that the city's success in many projects is due to the experience of the members of the traffic committee. Where sub-standard facilities are recommended, their effects are care-

● **VIEW looking southeast on East 14th Street at Bond Way.**

● **MOUNTAIN Boulevard and Calaveras Avenue, looking east.**



● **FIVE POINT intersection at Doolittle Drive and Hegenberger Road received channelization and traffic actuated signals. The six small diagrams show phasing for the signals. Note that only 98th Avenue traffic is subject to interference.**

fully considered and the objections are weighed against the benefits that could be obtained by a more extensive and expensive treatment.

Mountain Boulevard and Calaveras Avenue. Another intersection improved by the Committee was at Mountain Boulevard and Calaveras Avenue. The completion of Warren Freeway in 1959 created a problem by discharging the full load of a four-lane freeway immediately into a two-lane semi-improved city street. Prior to the freeway construction, Mountain Boulevard was carrying 9,000 vehicles per day. During peak hours, traffic on the Mountain Boulevard leg often backed up as far as one quarter of a mile beyond the intersection of Calaveras Avenue. It was realized that with the large increase of traffic to be created by the freeway, this location would become a major problem.

As a solution, a new west-bound free right-turn lane was constructed. This removed one heavy vehicular movement from the intersection which was then channelized. Mountain Boulevard is now carrying 23,000 vpd with no back-up. There have been no reported accidents since its construction one year ago. This record is truly a great accomplishment as the accident rate prior to construction was four accidents per year. The work was done by street department forces at a total cost of $3,575.

Doolittle Drive and Hegenberger Road. A third example of the committee's efforts to improve intersections was a project located at the five point intersection of Doolittle Drive, Hegenberger Road, 98th Avenue, and Maitland Drive. The complexity of the intersection, due to the street layout, coupled with the extremely heavy traffic volume on Doolittle Drive, created a problem which apparently could only be solved by an extensive grade-separated intersection. Numerous studies were made by the design engineer and then reviewed by the traffic committee. Ultimate treatment was considered impractical at the time since major changes would be required by future construction of a state freeway that would parallel Doolittle Drive. Since Doolittle Drive is a state highway, the California Division of Highways worked with our design engineer in developing the final approved plan.

To provide the necessary storage on Doolittle Drive, extra lanes were constructed on both legs of this street as well as left turn lanes. Hegenberger Road was widened to provide storage as well as a free right turn into Doolittle Drive. Traffic actuated signals were installed so that the Doolittle Drive left turn movements were individually omitted when not actuated. These two movements varied in volume and when there was no demand on one of these, the opposing Doolittle Drive traffic was allowed to operate providing maximum capacity on this street. This project was constructed by city forces. The total cost of $60,000 was shared on a 2/5 state, 2/5 city, and 1/5 Port of Oakland split, based upon the jurisdiction of the five streets entering the intersection.

Several factors have contributed to the success of this new traffic committee in solving the numerous traffic problems that have faced the City of Oakland during the last six years. The original committee was generally unsuccessful as it was hampered with public requests and public participation. The success of this new committee is attributed to the fact that the group operates as a staff organization using the technical ability and experience of each member.

SEWER INSPECTION
From an Easy Chair

● CLOSED-CIRCUIT television provides that long-sought-after look at the interior of a sewer, even one as small as 8-inch.

HAROLD S. RUDICH
President,
National Power Rodding Corporation,
Chicago, Illinois

This article is based on a paper presented at the 1960 Illinois Sewage Works Operators Conference.

ALMOST important function of sewer system maintenance personnel is the job of interior inspection. As sewers become old, changes may take place, such as misalignment, deterioration and open joints. When these failures occur, it becomes imperative to make a detailed inspection to determine the problem and solve it quickly and economically.

Normally the inspector is not always satisfied with what he has observed. As was said by one of them some time ago when told he should be able to look through a pipe at least a couple of hundred feet, "You may be looking, but you sure aren't seeing."

It has always been difficult to conduct a good inspection of any sewer line that a man could not actually crawl through. Lamping some sewers worked out fairly well as long as they were laid in a reasonably straight line and on a constant grade, but a minor deflection or curve can easily black out this method. In larger pipelines, the presence of gases has been a potential hazard.

Demonstrations have been conducted in the past by the National Power Rodding Corp. for civic officials, engineers and others on the technique of cleaning pipelines. After several years it became very evident that there was a need for a more exacting method of inspection of both newly-laid and old sewers.

After a number of experiences with conducting an inspection by pulling a line-sized mandrel or brush through a line we decided to try replacing the mandrel with a camera to take photographs as it was progressing through the sewer. A professional-type 35 mm movie camera specially modified to take single-frame shots was used. But to accommodate the camera in a watertight boat and strobe lights and to have the entire assembly activated from above ground, the equipment could be used in sewers only 15 inches or larger. After a period of use of this method certain drawbacks appeared. We were faced with the problem of not being sure while the photographs were being taken that every frame was a good shot—for instance, we could not be certain that the lighting was functioning properly or that the electronic activator was operating according to the settings. It was necessary to wait until the film had been developed and without a laboratory available for immediate servicing of this special type of film, additional delays would occur.

After a considerable amount of experimenting it was deemed possible to adapt a television camera, hooked up into a closed circuit, and built into a small enough housing to replace the still-shot camera. The smallest television camera was obtained, rebuilt and installed with inboard waterproof lighting into a 5½-in. stainless steel tube, small enough to pass through 8-in. sewer. Further miniaturization is being investigated to develop a unit compact enough to pass through a 4-in. sewer.

The monitor was installed in a field office trailer converted into a mobile TV studio. Ten to twelve observers can sit in air-conditioned comfort while witnessing the pipeline inspection. The viewing angle of the camera is such that the monitor will show just what the eye could see if it were possible to crawl through the pipeline. The phrase "eye to eye with problems," became a reality.

The television camera can be pulled through the sewer at a rate of speed varied as required by the inspector with a probable maximum distance covered for adequate inspection of 1000 ft. per 8-hr. day. The technician at the studio is in constant communication with the operator on the Power Rodder and directs the movement of the camera. In cases where it is necessary to pull the camera back, it is easily done with the power winch tag line attached to the rear of the camera case. On command, the camera is stopped, backed up or inched forward to get a better view of a particular section of the pipe.

A Polaroid camera properly adjusted can be used to photograph critical views directly from the monitor. It is also possible to use conventional 35 mm movie film in a specifically designed camera where a complete and permanent film record of the inspection is desired.

During heavy rainfall, much of the storm water could be carried through the sanitary system causing trouble at the treatment plant. Where this occurs, it is comparatively simple to pinpoint the trouble spots with a closed circuit TV inspection.

As was illustrated in Morton Grove, Illinois recently, a section of storm sewer in the middle of the street was filled with water to simulate a storm condition and TV inspection was set up in the adjacent section of the sanitary sewer located in back of the curb line. In the course of this inspection, three house laterals were discovered admitting storm water into the sanitary sewer at the rate of 150 gpm. This condition was occurring in only a few hundred feet of parallel sewers. Based on this rate, it is easily understandable what happens in miles of sewer systems where infiltration is not controlled.

The method also had advantages of allowing preventive maintenance inspections to discover pending trouble spots; permitting low cost repairs before a serious failure develops; providing a final inspection on new sewer, water main or deep well casing installations; locating buried manholes, inlets and outlets, or any other connections to the sewer where records have been lost; avoiding legal entanglements in working on or near private properties; spotting illegal connections; and permitting several officials and engineers simultaneously to examine the findings and to hold an "on the spot" conference.

A New Look at the Substance WATER

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U. S. Naval Engineering Experiment Station, Annapolis, Maryland

IT IS SAFE to say that everyone considers water a genuine necessity. On the other hand, few on first thought would consider it a competitor in novelty and glamor for space age wonders like nuclear power plants, earth satellites, and moon rockets. Perhaps we are so close to this commonplace substance that our picture of it is not clearly focused. It is time we took a new and better look, for water undoubtedly is destined eventually to become the most important of our resources.

Our new look should start inside the water molecule where modern concepts of structure provide a background of features that contribute to interesting potentialities.

Concepts of the water molecule have matured with the orderly transition from classical through atomic to nuclear physics. No longer is the hydrogen component pictured according to the basic Bohr concept of a satellite electron orbiting about a simple proton nucleus in a series of roughly circular concentric paths representing as many energy levels. Instead, it is represented as a relatively complex nucleus surrounded by a variety of somewhat abstract electron clouds, each representing a possible standing wave pattern, the product of a particular mass-energy relationship of the electron. These clouds are graphic representations of Heisenberg's famous uncertainty principle that says, in effect, it is certain only that the electron is somewhere in one of these clouds. The more certain its location, the less certain its movement, for the means of measuring one property hinders measurement of the other.

The nucleus within these standing wave patterns of electrostatic influence may be the basic proton variety some of us studied in high school or the heavy or extra heavy nuclei of deuterium (one neutron + one proton) or tritium (two neutrons + one proton). In any case, there will be an energy level pattern for the particle or particles rivaling that of the satellite electron and too complicated for proper discussion here.

The structure of water's oxygen component can be cast on the same pattern as that of hydrogen, but is far more complicated in detail because of its greater number of electrons and nuclear particles. For example, the 8 electrons must jockey for position in the electron clouds according to Pauli's exclusion principle, which permits only two, and these with opposite spins, to occupy

*The opinions in this paper are the Author's and do not necessarily represent opinions of the Navy Department nor of the Naval Service at large.

a given orbital. The nucleus may have 8, 9, 10, or even 11 neutrons in addition to its complement of protons, yielding atomic weights of 16, 17, 18, or 19.

One would certainly guess that these two components will produce a great variety of molecules (isotopes), and they do. Water, once considered to be H_2O, now comes in at least 18 different varieties of molecular structure, not counting compounds of the short lived oxygen 19 (less than one minute half life). Of these, deuterium oxide (D_2O), representing about 300 parts in every million, is the best known and most widely used special variety (isotope). Tritium compounds are attracting more and more attention.

The macro structure of water also is complex. For example, there is evidence that each body of water, even the ocean, is a single gigantic molecule or lattice, which might be written $(H_2O)_n$.

Fresh Water in the Sea

Locked in the complex atomic and molecular structures of water are the secrets to many unusual properties which continue to appear as explorations in science proceed. Self desalting of sea water, presumably by fractional crystallization and stratification, was reported by the USS NAUTILUS on its historic transit under the polar cap. This process is so effective that a 10 or 12 foot layer of fresh water separates the sea from the ice ceiling in some places. Objects of proper specific gravity will sink through this fresh layer and stop abruptly on the surface of the salt. This is a tantalizing phenomenon to scientists who are attempting to produce the same salt separation by control of crystal growth during freezing.

Equally interesting is the recent evidence that minute nuclei of undissolved solid and gaseous matter cause weak spots in the otherwise strong rope-like structure of water, so that it tears and cavitates with damaging effects on water handling equipment. What laymen would buy such a story on first reading? Yet experimenters working on the basis of this theory have reduced cavitation by pressurizing water and the troublesome nuclei to lessen the likelihood of their releasing bubbles and starting tears.

The heavy weight relatives of ordinary water have some peculiar properties too. Deuterium oxide (ordinary heavy water) will not quench thirst nor will it support plant life. When more is learned about tritium oxide and the other isotopic forms, the list of interesting new properties undoubtedly will expand.

Profitable New Uses

While most of us are seeking new sources of water for the already too numerous uses, others are finding new interesting uses for the water we already have. Ordinary tap water is being used to indicate radiation intensities by means of the Cerenkov Glow, a ghostly bluish-white light it emits when bombarded with charged particles traveling at speeds greater than that of light in water. The high speed is generated by radiation in a vacuum. The wave length and intensity of the glow indicate the velocity and mass of the impinging particle.

Another somewhat more familiar application based on impinging particles involves the exceptional capacity of deuterium oxide, ordinary heavy water, to act as a neutron moderator in fission reactions. The cross-sectional characteristics of the deuterium nucleus are just right for slowing bombarding neutrons, without trapping them, so that they land with a dull thud of devastating fission effects in the fuel nuclei of the reactor.

Use of tritium oxide (T_2O) concentration in determining makeup rates in ground waters, particularly captive well waters, is just as interesting. Radioactive T_2O formed by cosmic effects in the atmosphere has a half-life of about 12 years so that its ratio to other molecules is a real tattle-tale. Accurate knowledge of water makeup rate is important in seeking dumping grounds for radioactive wastes.

Production of breathing oxygen for the long submergence submarine by distillation of sea water and electrolysis of the distillate is a less glamorous, but a far more important new water utilization process. When an electrolyzer of a suitable type is perfected, man can live under water until he runs out of food or gets homesick.

Traveling a little further into the fantastic, it is conceivable that one might eventually split water into ions (H^+ and OH^-), and maintain these free radicals immobile with liquid helium refrigeration near absolute zero until their terrific recombining energies are reclaimed in rocketry or other special applications. If you are skeptical of this possibility, better recalibrate your attitude against those skepticisms that existed only a decade or two ago.

Despite the fairy tale flavor of this excursion through the looking glass, it is safe to say the water carnival hasn't even started. Space age technology is demanding more and more power and obtaining fewer and fewer miles per calorie. One day, present conventional sources of power will be depleted and nuclear fission by that time may be an impracticable means of supplying the demand. Nuclear fusion is the logical answer to this eventuality. Considering mass relationships of earth substances, only the traces of deuterium and tritium, which occur in all natural waters, are suitable raw materials for a workable fusion process. The reaction $T^3 + D^2 = He^4 + n^1 + 17.6$ Mev (million electron Volts) could generate billions of BTU of energy per pound of water. The estimated 10^{17} pounds of deuterium in the oceans thus could provide millions of times more energy than all fission sources put together.

Not Without Problems

Progress invariably involves problems and water has created its share. The chloride stress corrosion cracking threat in nuclear-powered stainless steel steam generators is a familiar example. Snow clogging of jet fuel lines and filters by freeze-out of dissolved water at high altitudes is a less familiar, but equally troublesome example. Conductivity problems in radar cooling systems due to traces of metallic impurities in the cooling water have caused headaches. Significant radioactive contamination of industrial and domestic water supplies is a definite possibility today, although it was scarcely heard of a few years ago. One can only guess what new problems may accompany further excursions in water technology.

If history is any indication of the future, we cannot expect to find this ancient substance water in many new roles as science and technology advance with geometric strides—old wine in new bottles to be sure. Each new use undoubtedly will become as commonplace as those we know today and the problems associated with them probably will seem no more complex in retrospect. One can expect that each new problem will be attacked with the vigor and resourcefulness that always have characterized the field of water technology.

This paper, which has been slightly condensed, was presented at the Industrial Water Sessions of the Third National Pacific Area ASTM Meeting, and was published in the "ASTM Bulletin" for January, 1960.

SEWER SYSTEM HAS 17 LIFT STATIONS

CLAUDE LESSIG
Design Engineer,
and
F. LEE ROSS
Project Engineer,
J. Stephen Watkins,
Consulting Engineers,
Lexington & Louisville, Kentucky

A SUBURB of Louisville, Shively is Kentucky's fastest growing city with a population of over 13,000. Like many suburban communities in America, it has stolen the population spotlight from its metropolitan neighbor with an increase of nearly 530 percent in the last 10 years.

There is a reason for it. Shively is strategically located at the western terminus of the busy Watterson Expressway which encircles the southern and southeastern part of Louisville. Its "Main Street" is the Dixie Highway, the principal route from Louisville to Ft. Knox, Elizabethtown, Nashville and cities in western Kentucky. During the past 10 years there has been extensive commercial development along both sides of the Dixie Highway for a distance of more than 12 miles south of Louisville, and Shively has grown with it.

Although Shively is chiefly known as a distillery and tobacco center, its economy is tied closely to that of Louisville, probably the only city in the United States that has been allowed to make a virtue of tobacco, alcohol and horse racing. Churchill Downs is little more than a mile from downtown Shively. Louisville's Standiford Airport and the Kentucky State Fairgrounds are less than five minutes from Shively's fast-growing suburban area — and most of the community is within three miles of the center of Louisville's business district.

It was logical that the city would grow, and with it suffer growing pains, part of which were caused by the lack of sanitary sewers. It has been a city of septic tanks and disposal pits which overflowed when the rains came.

Sewerage Problem Grows, Too

Historically, this area was a flood land of the Ohio River. In the 1770's early settlers established their farms on the highlands to escape flood

● **THIS pumping station was installed near a school. Because of the terrain it was economical to utilize 17 lift stations to avoid excessively deep sewer lines.**

● **COLOR MAP shows the location of Shively; the principal sewers; the lift stations, differentiated by type used; the sewage treatment plant; and the river outfall.**

● PNEUMATIC ejector was installed in this lane. Note the trencher and pipe laying work proceeding in the background.

● THIS pre-fabricated lift station is equipped with an elevator. Pumps have capacity of 275 gpm. Station is 8-ft.

waters. The Ohio was a menace until a floodwall was constructed to protect Shively and its environs after the record 1937 flood.

Gradually, building sites spread down the hillsides. Then, the post-war boom created new homes and buildings in the low-lying areas. Although protected by the floodwall and by higher land to the east, it was impossible to prevent individual disposal systems from flooding. A recent five-inch rain served only as added proof of the need for a municipal sewerage system.

The citizens of Shively had considered the necessity of constructing such a system for many years. At first, they explored the possibility of tying to the southwestern outfall of the Louisville and Jefferson County Metropolitan Sewer District which traverses the northern section of Shively and which serves, by special contracts, major industries and a small residential section. A thorough study of the proposal revealed that Shively could be served better at lower cost by the construction of its own system and sewage treatment plant. Accordingly the consulting engineering firm of J. Stephen Watkins and Robert E. Martin of Louisville and Lexington planned the sewer system to flow in a southwesterly direction along natural drainage courses to a treatment plant to be located on Mill Creek.

With nearly 60 miles of 8-in. to 18-in. sewers, 17 sewage lift stations, a primary-type treatment plant and a 2½-mile force main outfall to the Ohio River, the system was designed to meet the present and immediate-future needs of the community, with provisions for expanding the treatment facilities to meet long-range demands. When completed in mid-summer 1961, the system will serve an estimated 4,430 residences, 79 apartments, 197 businesses, 11 churches, 6 schools and motels containing 175 rooms.

The joint bid of the R. B. Tyler Company of Louisville, Kentucky, and the Hyde Construction Company of Jackson, Mississippi, was accepted for the construction of the entire system at a cost of $2,700,000. The joint venture of these two companies is called Hy-Ty-Co.

Large Area Served

The sewer system was required to serve a large, relatively flat area. Minimum grades for the sewers provided a velocity of 2 ft. per sec. when flowing half full. Trench excavation in excess of 18 to 20 feet was considered both undesirable and uneconomical; therefore design criteria provided for the general use of lift stations when sewers in the system reached this depth.

● LIFT station shown here is pneumatic, one of six such stations. Capacity is 75 gallons per min. at 30-ft. head.

Under these conditions, 17 lift stations were required. With their use the average depth of the sewers is between eight and ten feet, with maximum depth in the system reaching 24 to 26 feet. The design took advantage of the economies and ease of installation of factory-built sewage lift stations which could be placed in the network with a minimum of inconvenience to adjoining property owners. Nine of the stations were installed in an average installation time of two days each, including excavating and backfilling.

All but the three largest pumping stations were manufactured by Smith & Loveless, a Division of Union Tank Car Company, Lenexa, Kansas. The eight factory-built pumping stations in the system have capacities ranging from 120 to 480 gallons per minute against a TDH of from 30 to 55 feet. Seven of the eight stations are equipped with elevators to transport the maintenance man from ground level to the pump chamber.

Six Smith & Loveless "Mon-O-Ject" pneumatic ejector lift stations were specified for low-capacity points in the system. Capacities range from 30 to 100 gallons per minute against a TDH of up to 45 feet.

A typical factory-built pumping station installation, the Ralph Avenue Station, has an 8-ft. diameter pumping station with 6-in. suction and 6-in. discharge piping. It is equipped with two 4-in. Smith & Loveless pumps with mechanical

seals, connected to 7½-hp, 1150-rpm motors, capable of delivering 275 gallons per minute at 30 feet TDH. The 48-inch diameter entrance tube was shipped to the job site in two eight-foot sections and is equipped with an elevator.

The concrete wet well or receiving manhole beside the Ralph Avenue Station was pre-cast in four sections—a base, a 24,000-pound center section, a cover and an access chimney.

Three job-built pumping stations of reinforced concrete and masonry will serve as collection points in the system, dividing it into three subsystems of factory-built stations. The largest of these is located on the main sewer outfall along Mill Creek. The second largest job-built station serves as a collection point for the discharge from four factory-built pumping stations and one pneumatic ejector along the Dixie Highway commercial district in eastern Shively.

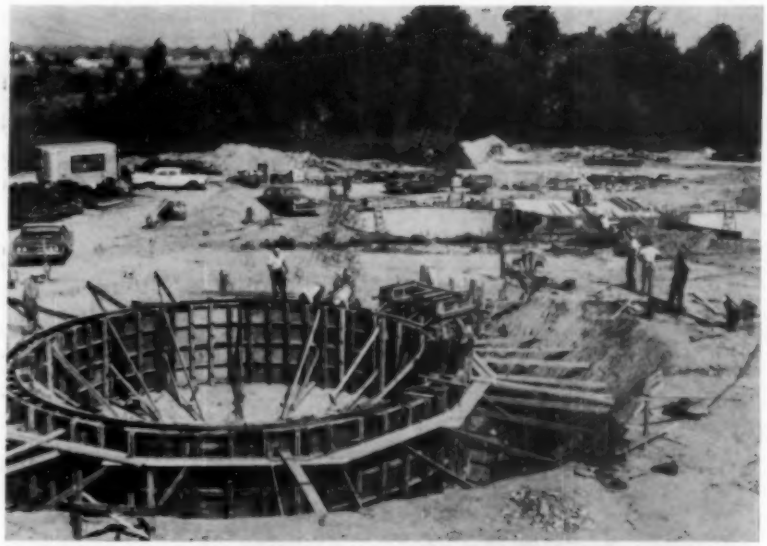
For construction of the eight factory-built pumping stations, complete in place, the successful bidder submitted unit bids averaging about $18,675 each. Similarly, the average bid for the six ejector stations was about $9,650. Costs for the three job-built pumping stations were approximately $35,000, $37,000 and $45,000.

The Sewer System

As being constructed, the sewer system consists entirely of vitrified clay pipe sewers with polyvinyl chloride joints. The specifications and proposal set forth that only a portion of the sewers need be constructed with the PVC joint; however, the contractor elected to use it throughout the project. The size of sewer pipe installed on the project ranges from 6 to 18 inches. The pipe is being manufactured by the Cannelton Sewer Pipe Co.

Nearly all of the sewer lines are being placed in easements behind the houses to keep street pavement repair cost at a minimum and to afford shorter service connections for individual property owners since the present septic tanks and pits are located in the rear of the houses.

According to Farris C. Gibbs, Project Manager, and James C. Fortenberry, Engineer for Hy-Ty-Co., the installation of the sewer system is proceeding on schedule. The only obstacle has been a layer of sand and/or sand and gravel underlying a layer of sandy clay that was encountered on the main outfall line along Mill Creek. This lower layer of sand, about 14 feet below ground level, caved into the trench, creating a void behind the sheeting in the lower portion of the trench and leaving the layer of sandy clay above it unsupported. This caused subsequent subsidence of the backfilled trench and possible movement of the pipe. The condition was partly overcome by utilizing a trenching machine with an attached shield which allowed the contractor to install sheeting simultaneously with the trench excavation. It was also necessary to leave considerable sheeting in place along this line.



● **PLANT under construction. Designed for a population of 15,000 organic loading and 2 MGD hydraulic loading, plant will provide sedimentation and digestion.**

Treatment Plant Design Bases

A recent census by the City of Shively indicated that the population was 12,658 persons. Available land for home construction within the existing city limits (150 to 200 acres) and past trends indicate that a population of approximately 15,000 persons may be expected by 1975; the ultimate or saturation population for the entire area should not exceed 20,000 persons.

Water consumption records for four Jefferson County water districts indicated a present consumption of approximately 50 gallons per capita per day. Since the trend seems to be toward increased water consumption, the water returned to the sewers was estimated to be 55 gpcd for 1975 and 60 gpcd for 1990.

Based on specification allowances and the use of special joints at points in the sewer system likely to be subjected to serious ground water, infiltration was taken to be 35 gpcd for the year 1975 and 40 gpcd for the year 1990. Using these data, the sewage treatment plant was sized for a population of 15,000 persons with sewage flows estimated at 90 gpcd. Plant hydraulic design was based on a population of 20,000 persons with sewage flows estimated at 100 gpcd, to allow for future expansion.

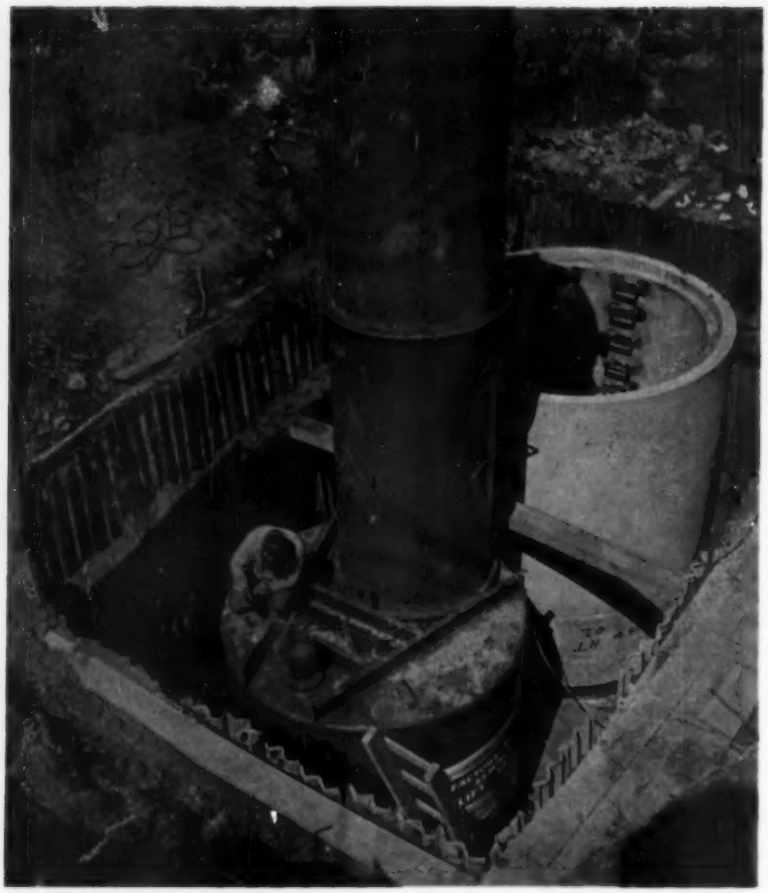
The sewage treatment plant includes the following major units:

Metering Assembly. The metering assembly consists of a 6-in. Foxboro magnetic flow meter for metering sewage pumped to the plant.

Shredder and Grit Chamber. Two channels have been provided, with shredding and grit removal equipment to be presently installed in only one channel. The second channel will operate as standby only until future flows require the installation of equipment. Each channel has been designed to handle 1.5 times the present design flow. Major equipment includes a Worthington comminutor and a Link - Belt straight line grit collector with inclined screw grit washer.

Clarifiers. Two 35-ft. diameter clarifiers have been provided, each having a capacity of 675,000 gpd based on two hours detention. The clarifiers have an overflow rate of 700 gal./sq. ft/day, a depth of eight feet and an overflow weir rate of slightly more than 6000 gallons per foot of weir per day at a flow of 1.35 mgd. The Dorr-Oliver clarifiers will be equipped with mechanical sludge and scum removal equipment. Provision is made for the installation of a third clarifier at a later date.

Digesters and Combined Control and Head House. Two digesters which incorporate Dorr - Oliver's



● **WELDER completes field assembly of one of the factory-built pumping stations.**

Multdigestion system have been used. One will be heated by recirculated sludge passing through a heat exchanger and will be equipped with a mechanical mixer. The other will be equipped with a floating cover for gas storage to serve, generally, as a sludge holding tank. The two digesters have a combined capacity of 3.0 cubic feet per capita for 15,000 persons. Raw and recirculated sludge pumps have been furnished by Western Machinery Company.

Since the plant is situated near housing developments, chlorination equipment has been provided in the combined control and head house for pre-chlorination to alleviate any offensive odors that may be present while the sewage is being treated. Chlorination equipment of the V-notch weir type has been furnished by Wallace and Tiernan, Inc.

Sludge drying beds are designed for 1.25 sq. ft./capita for 15,000 persons and are provided with truck runways to facilitate loading of dried sludge.

Effluent Pumping Station. This is equipped with two pumps having magnetic variable speed drive, each operating between the range of 400 gpm to 2100 gpm. Pumps were furnished by Yeomans Brothers Company; pump drives were furnished by Electric Machinery and Manufacturing Company.

The treatment plant effluent is pumped by the effluent pumping station to the Ohio River, a distance of approximately 2½ miles. This outfall line is constructed of cast iron pipe with single rubber gasket seal joints.

The plans and specifications for the project were approved by the Kentucky Water Pollution Control Commission, the U. S. Public Health Service and the Louisville and Jefferson County Metropolitan Sewer District.

The management, control, operation and maintenance of the municipal sewer system will be under the authority of the Shively Sewer Board, a non-partisan and non-political body appointed by the Mayor with the approval of the City Council. The terms of office of the five members are arranged so that one vacancy will occur each year.

The present members of the Sewer Board are five prominent businessmen: William J. Conley, Carter P. Steffey, John A. Celletti, William A. Cambron and Howard C. Reeves.

Financing the System by Bonds

The project was financed by the issuance of $3,855,000 in revenue bonds and by a Federal grant of $150,000. The bonds will be amortized by a monthly service charge to be paid by the sewer users. The monthly rates are $6.25 per month for residences and $10 to $25 per month for businesses. The City has no other bonded indebtedness and Shively's current tax rate is 40¢ per $100 assessed valuation, compared to the limit of 75¢ fixed by Kentucky statutes.

A Rate Ordinance, passed by the City of Shively, established rates and charges for sewer service and conditions for use of the new sewer system. This ordinance binds the users of the sewer system by law to abide by its rules, regulations and conditions and provides penalties for owners or occupants of premises failing to connect to the sewers or failing to pay the sewer bill. Pertinent provisions of this ordinance regarding enforcing connections to the sewer are as follows:

All owners and occupants of premises where sewers are available shall connect to the sewer within 90 days after the sewer is installed and in operation.

Any person, firm or corporation failing or refusing to connect to the sewer shall be fined not less than $5.00 nor more than $25.00 for each day they fail or refuse to make the connection.

Approximately 88 percent of the sewer users in the City of Shively are customers of the City of Louisville Water Company, 10 percent are customers of the Louisville Extension Water District and the remaining 2 percent obtain water from their own wells. Both water companies have agreed to collect sewer service charges for the City of Shively by including the charge on their regular water statements to customers and issuing sewer-service statements to well owners.

The City of Shively has had growing pains which were magnified by its previous lack of a sanitary sewerage system and by its highly accelerated growth rate. The new municipal sewerage system will help by attracting more growth and by protecting the health and welfare of the citizens residing and working there.

NEW COMPACTOR

Replaces Two Open Trucks and Halves Collection Costs

FRANK FORCE

Manager-Engineer,
Hellertown, Pennsylvania

WITH THE PURCHASE of an 18-yd. Gar Wood Model LP-618 Load Packer, the Borough of Hellertown, Pa., cut their refuse collection costs in half. Formerly two dump trucks and six men were used to collect refuse. With the new compactor only three men are required for collection and the costs of truck maintenance have been reduced.

The 18-yd. compactor is installed on a Chevrolet Model C 8803 truck. Bids were taken on a 17-yd. Leach compactor and an 18-yd. Gar Wood compactor or equals. The rear load type compactor was selected as the type most practical for operation in the Borough.

Specifications written for the truck manufacturers to follow called for a new 1960 model, 26,000 GVW unit with a 6 cylinder or V-8 engine of at least 340 cu. in. displacement, single axle, conventional cab or cab forward. The CA dimension was 120 inches minimum. A 13-in. clutch, single speed rear end and five-speed transmission were required. Specifications included a front axle of 9,000 lbs. capacity and a rear axle of 18,000 lbs. capacity. Springs are 4,500 lbs. capacity each on the front and 11,500 lbs. capacity each on the rear. Other specifications covered the hydraulic brake system, truck frame, tires, battery, rear vision mirrors, heater and defroster. An optional bid including power steering was required. Two used dump trucks were traded for the new equipment.

Bids received ranged from $7,495.25 to $11,400.00 and covered both types of compactors installed on several different makes of trucks. The low bid, submitted by Hauser Chevrolet Co. of Bethlehem, Pa., met all specifications and included power steering. Hence they were awarded the contract.

● **COMPACTOR furnished by Gar Wood has halved labor requirements for refuse collection. Unit is shown here on collection rounds. Note tree limbs along curb at center.**

Hauser Chevrolet gave a one-year warranty or 12,000 miles on all major components (engine, transmission and rear axle). The firm's service station is open 18 hours a day, from 7 a.m. to 1 a.m.

Merkin Spring and Equipment Co. of Easton, Pa., who sold the compactor body to Hauser Chevrolet, guarantees their unit for one year on all moving parts and offers repair service 24 hours a day, seven days a week. A qualified man was furnished to instruct the Sanitation Department on the operation of the new unit.

The Gar Wood compactor takes only 10 seconds to complete a full cycle and the crew can start reloading in 4 seconds. It has a 1½-yd., 74-in. wide hopper into which two

● **SPRAYER is used to apply a concentrate regularly to prevent odor production and to aid in removal of slime.**

● **WELDER** completes field assembly of one of the factory-built pumping stations.

Multdigestion system have been used. One will be heated by recirculated sludge passing through a heat exchanger and will be equipped with a mechanical mixer. The other will be equipped with a floating cover for gas storage to serve, generally, as a sludge holding tank. The two digesters have a combined capacity of 3.0 cubic feet per capita for 15,000 persons. Raw and recirculated sludge pumps have been furnished by Western Machinery Company.

Since the plant is situated near housing developments, chlorination equipment has been provided in the combined control and head house for pre-chlorination to alleviate any offensive odors that may be present while the sewage is being treated. Chlorination equipment of the V-notch weir type has been furnished by Wallace and Tiernan, Inc.

Sludge drying beds are designed for 1.25 sq. ft./capita for 15,000 persons and are provided with truck runways to facilitate loading of dried sludge.

Effluent Pumping Station. This is equipped with two pumps having magnetic variable speed drive, each operating between the range of 400 gpm to 2100 gpm. Pumps were furnished by Yeomans Brothers Company; pump drives were furnished by Electric Machinery and Manufacturing Company.

The treatment plant effluent is pumped by the effluent pumping station to the Ohio River, a distance of approximately 2½ miles. This outfall line is constructed of cast iron pipe with single rubber gasket seal joints.

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men can load at one time. Controls are simple and easy to operate.

Collection Service

The Borough of Hellertown has 1929 residential accounts and 27 business accounts. There is one pick-up a week at all residential stops and three pick-ups weekly at the business places. The largest supermarket in the Borough is served six days a week and there are five pick-ups a week at the schools. The Borough has an agreement with the City of Bethlehem to use their sanitary landfill for disposal of the refuse. An average of two loads is picked up each day.

Solvex concentrate, made by National Chemsearch, is used weekly to control odors in the refuse compactor body and to keep it free from slime and grease deposits. A sprayer made by Dobbins Equipment Co. is used to apply the solution.

Rates for residential service are $18 a year and commercial pick-ups are $62 a year. Both classes of service are allowed a 15 percent discount if bills are paid within one month after receipt. Then for one month the regular price is charged, and for accounts overdue for more than a month a 5 percent penalty is applied. For 1960 the income from collection charges is estimated at $33,000.

In the past, operating with two open dump trucks, the Sanitation Department was staffed with five laborers and a Superintendent. With the new compactor unit in operation, a Superintendent and two laborers are sufficient to run the department. Thus the cost of labor is reduced to one-half the former amount. In addition the cost of truck operation is cut approximately in half with only one truck in use instead of two. The saving in labor cost is approximately $10,000 per year and an additional $1,000 per year is saved on truck maintenance and incidentals.

Next year it is hoped to reduce the charge made to property owners for refuse collection. Something like a 20 percent discount, instead of the current 15 percent, has been discussed. Also, service in the residential sections of the Borough can be stepped up to two collections every week after the route system has been thoroughly studied and operation of the compactor unit has reached a point where two collections are feasible.

The Burgess of Hellertown is Warren C. Fritchman, Chairman of the Sanitation Committee is Max E. Parsons and the Sanitation Superintendent is Franklin Rinker.

SCHOOLHOUSE ON WHEELS FOR EQUIPMENT OPERATORS . .

FRANK E. BAXTER
Maintenance Engineer
California Division of Highways
Sacramento, California

THE CALIFORNIA Highway System with its 14,000 miles of state highway, its widely-varied terrain and climatic conditions, and its diverse types of road construction, offers challenging maintenance problems requiring highly-skilled equipment operators. To provide a force of well-trained operators, an integrated personnel selection and training program has been developed.

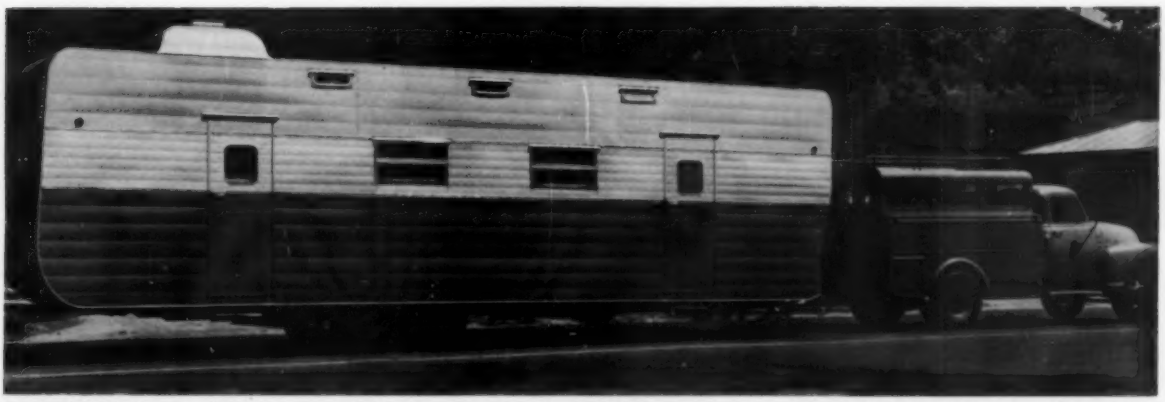
The basis for a well-qualified operating force, and the starting point for any training program, lies in the selection process. The amount of training a new employee needs depends upon his past experience. In our Division, we select new equipment operators who have some experience in the operation of at least one type of equipment. This experience must equal at least one year of operating tractors, graders, 3-ton or larger trucks or other construction or maintenance equipment.

Our selection process begins with a careful screening of applications to see that all meet our experience standard. An applicant who has the necessary experience next completes a written test measuring his mechanical aptitude and testing his knowledge of servicing, adjusting, repairing and operating equipment. Thus, we verify that the person who wishes to operate our equipment has learned from his prior experience and has the aptitude to learn more.

To assure further that persons we hire have the necessary background and aptitude, we are experimenting with a performance test. Persons who pass our written examination must actually demonstrate their ability to operate a dump truck and a motor grader. While our performance test is new, our experience indicates that it will help us to select the best qualified applicants.

Having selected new operators who have some skills as equipment operators, our training problem becomes one of helping them to expand these skills. The new operator must learn to use his equipment under highway conditions of roadbed, climate and terrain. He must operate this equipment in a manner that meets our standards. Finally, he must learn to operate types of equipment with which he is not familiar.

The new operator is assigned to one of our maintenance crews. Each crew has a foreman. Each foreman reports to a maintenance superintendent who supervises all maintenance operations in his territory. The superintendent and the foreman are familiar with every mile of road in their territory and know all the requirements for equipment operation within it. Training the new equipment operator is the responsibility of his foreman. Usually a more experienced operator is assigned to instruct the new man under actual job conditions. Maintenance superintendents check to see that each foreman trains and develops his crew to meet the needs of his territory. This on-the-job training has proved most effective



● TRAVELING schoolhouse is a specially constructed trailer which is moved to locations throughout state as may be needed.

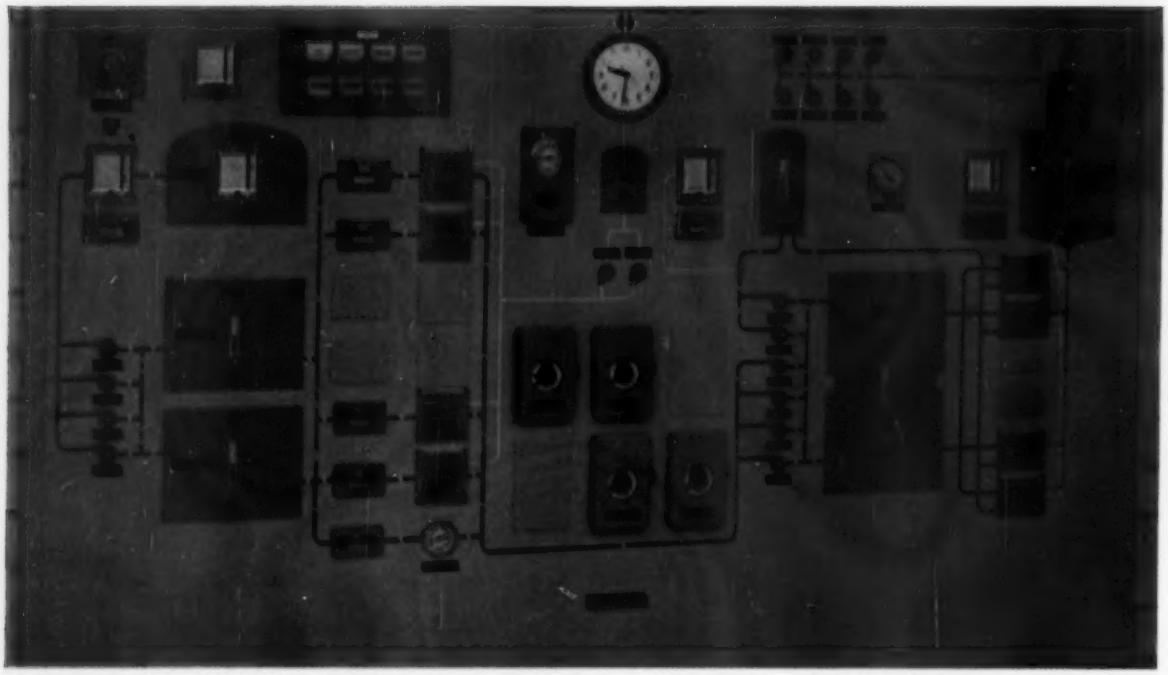
in providing a flexible work force which meets the varied needs on each maintenance crew.

Training in the proper care of equipment is given to operators by the equipment department. Trained instructors from headquarters give a 14-hour formal training course in "Lubrication and Preventive Maintenance." This training is given in a specially-constructed classroom trailer at locations throughout the state where operators need the training. In the past two years, 2,255 employees were trained. Training was held at 80 different locations, and the trailer was moved 5,576 miles to accomplish this. The equipment department reports that this training has reduced materially the unit cost of servicing and repairing equipment.

One additional aspect of the training remains. As new or revised types of equipment become available, our crews must learn their operation and care. To give operators detailed information about this new equipment, the equipment department has a second training course, "Mechanical Features of Equipment Operations." Instructors from the equipment department familiarize themselves with each type of new equipment by contacting the manufacturers, reading the manuals and operating the equipment. Then they formulate a training course in its use and give the training to our operators. The classroom trailer is used to bring the training where it is needed.

Thus, our program for equipment operators begins with a selection process design to recruit persons with skills and aptitudes for equipment operation. Initial training of these operators becomes the responsibility of the foremen who are best qualified to know the kinds of equipment the men must use. Training in preventive maintenance and lubrication is given by our equipment department, which also gives formal training in the care and operation of new equipment. The selection and training program outlined above meets our needs for a skilled operator force to maintain our highways.

● INTERIOR of class-room trailer showing some of the instruction facilities. About 18 students can be seated at a time.



● GRAPHIC panel serves as an observation post, reflecting the status of operations with indicators, recorders and alarms.

Treatment Plant Provides Iron Removal and Softening

R. E. PETERS
Partner, Burgess & Niple
Consulting Engineers,
and

KENNETH W. COSENS
Associate Professor,
Civil and Sanitary Engineering,
The Ohio State University,
Columbus, Ohio

Instrumentation for operator efficiency was the design goal, to reduce requirements to one man per shift. The result is a semi-automatic plant in which the instruments inform the operator to initiate controls for the complex plant functions.

WATER for Lancaster, O., a city of 30,000, is procured from wells located in the flood plain of the Hocking River Valley. The wells, averaging from 80 to 115 feet in depth, are located in a gravel and sand aquifer which has provided water for the municipality since 1879. This aquifer, which also provides water for many private and industrial wells, has shown little change in static level over this period.

Water consumption averages 120 gpcd and finished water production is presently near 3.6 MGD. The water has a total hardness and iron content of 425 and 3.8 mg/L respectively, requiring that it be softened after the iron is removed. It is of interest to note that between 1935 and 1955 the raw well water hardness increased 20 percent and the iron increased 39 percent.

The new treatment plant supplements an existing 2.5-MGD facility which produces an iron free, ion-exchange softened water. Either plant may be operated independently of the other except that water is supplied from the same wells. The operating capacity of the plant as now equipped is 6.3 MGD based on a filtration rate of three gpm/sf and a softener rate of six gpm/sf. Two filters and two softeners have been built but not equipped and space has been left for an additional aerator. When these have been added, the capacity will be increased to 9.5 MGD.

The new plant was erected on a pile foundation and is of concrete, brick and tile construction. Selection of building materials, material texture, color and finish and planning of the plant layout was done to make an attractive as well as serviceable structure. It is connected to the older waterworks building by an enclosed passageway.

Aerators and Settling Tanks

Discharge from the wells is to the top of either or both of the all aluminum forced draft aerators, each of which has 5 hp motors driving 12,700 cfm blowers. Air is forced up through the water as it splashes down through aluminum slats. Air discharges through a screened, canopied opening at the top of the aerator. Water leaves the aerator through a 4-inch water seal to pre-

vent loss of air, and is directed to the influent end of the settling tanks.

Control of flow is possible at the inlet end of the two covered settling tanks; consequently the water may be directed through either or both of these tanks. Each basin is about 12 feet wide by 71 feet long with an average depth of 10 ft. 4½ in. and in parallel service provides about 20 minutes detention at a 9.5-MGD rate. Each basin may be dewatered for cleaning or maintenance without influencing operation of the other. Precipitated iron sludge is removed periodically by dewatering the tank and hosing the sludge to drains at the inlet end. Individual overflows are provided on each settling tank.

Filters and Filtered Water Clearwells

Six manually operated rapid sand gravity type filters are provided, four of which are equipped and operating, to remove the remaining precipitated iron turbidity from the settled water. Each filter is 19 ft. by 19 ft., providing 361 square feet of sand area. The filters have a central gullet fed by six fiberglass wash water troughs reinforced with stainless steel bracing. Each filter is equipped with four self-propelled rotating type filter sweeps. Clay underdrains were used with 8 inches of gravel, from 1/8-in. to 1-in. diameter, over the underdrains; two inches of torpedo sand rests on the gravel; and 22 inches of filter sand, having an effective size of 0.45 to 0.60 mm and a uniformity coefficient of not more than 1.7, forms the bed.

The filters are manually controlled by pneumatically operated butterfly valves from controls on the individual consoles at each filter. The filter backwash rate can be varied from 3000 to 6000 gpm which is equivalent to 13.3 to 26.6 inches rise per minute.

Filtered water discharges to either of two interconnected clearwells, which may be operated individually to facilitate cleaning and maintenance. Their total capacity is 584,000 gallons and water depth is 16 ft. when full.

Pump Room

Water is pumped three times before it reaches the consumer, once by the well pumps; again by the low service pumps from the filtered water clearwell to the softeners: and then by high service pumps from the finished water clearwell to the water distribution system and storage.

A single pump room houses four high lift pumps on one side and four low lift and two wash water pumps on the other side. The low service pumps and the wash pumps take suction from a common manifold that terminates in both filtered water clear wells. The high service pump suction manifold terminates in the two finished water clearwells. In an emergency it is possible for the high service pumps to take suction from the filtered water clearwell. An electrically operated hoist and monorail system serves the entire pump room.

All pumps are centrifugal, driven by constant speed induction motors. Vacuum priming, by the removal of air from the top of pump casings, assures primed pumps under all conditions of operation. With full clearwell, the static positive pump suction head exceeds 6 feet but with the clearwell nearly empty the static negative suction head may approach 10 feet.

A 2½-in. fire hose connection on the discharge side of the smallest low service pump makes it possible to dewater any of the four clearwells. This is a convenience that is appreciated when the plant is being cleaned up for service and whenever clearwells need cleaning or maintenance.

All pumps are equipped with gate valves on the suction side and check and gate valves on the discharge side. The check valves on the high service pumps are hydraulic cylinder operated cone valves with solenoid actuated controls and limit switches. Low service and wash water pump check valves are non-slamming, externally balanced. All pumps in the pump room are manually actuated, except the wash water tank refill pumps, which shut off automatically.

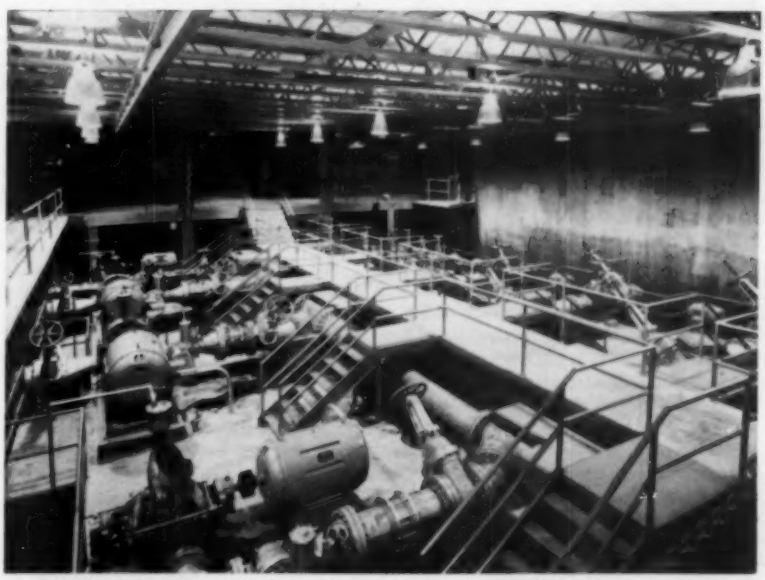
The Softening Cycle

Space is provided for six downflow ion exchange softeners which

Table 1—Pump Data

Pump Use	No. of Pumps	Capacity, gpm	Opr. Head, ft.	No. of Stages	Speed, rpm	Voltage	Efficiency,* Percent
Low Service	1	1,100	26	1	1150	480	78.5
Low Service	1	2,200	26	1	880	480	73.5
Low Service	2	3,300	26	1	880	480	74.0
High Service	1	1,100	330	2	1750	4160	74.0
High Service	1	2,200	330	2	1750	4160	78.5
High Service	2	3,300	330	2	1750	4160	78.0
Wash Water	2	1,000	91	1	1750	480	75.5

*Wire to water



● PUMP room with four high service pumps on the left delivering softened water to the distribution system under a 330-ft. head. These are equipped with cone check valves on the discharge side. Four low-service and two wash water pumps are shown on the right. The room is equipped with an electrified monorail and hoist system.

are regenerated with sodium chloride. Four of the softeners are equipped for immediate service. Based upon 25 gpg hardness in the filtered water and 4-grain finished water it is necessary to soften 84 percent of the water and bypass 16 percent of iron-free water around the softeners to the blending chamber of the finished water clearwell.

Each softener is provided with a console which houses all the appurtenant operating control gear. The ion exchange units are 13.5 by 13.5 ft., providing 182 square feet of surface area. The beds have a central gullet and four fiber glass wash water troughs. Brine is discharged at the top of the exchanger media through 3-in. red brass piping with ¼-in. holes at 4 3/16-in. c-c with spacing staggered on both sides of the horizontal pipe diameter, so that there are 37 holes for each of 4 distributor pipes per filter. Depth of the exchange resin is 4.5 feet; it rests on 2 ins. of torpedo sand on 8 ins. of gravel having the same size distribution as for the sand filters.

Each softener, containing 820 cubic feet of 20,000 grains per cubic foot exchange capacity resin, will zero-soften 656,000 gallons of 25-grain hardness water before regeneration is required. Iron-free water is applied to the softeners at the maximum rate of 6 gpm/sf.

When a predetermined quantity of water passes through a softener an alarm sounds and the exchanger must be backwashed and placed on the regeneration cycle. Backwashing, provided by water from the wash water tank, cleans and reclassifies the ion exchange resins. Wash water is then drained close to the top of the resin and the regeneration cycle is manually started. Once started, it automatically goes through brining, slow rinse, rapid rinse and shut-off.

For a bed having 820 cubic feet of resin and using 7 pounds of salt per cubic foot for regeneration, 5,740 pounds of sodium chloride are required per cycle. Assuming 2.6 pounds of salt per gallon of saturated brine, 2200 gallons of brine must be delivered by the 240-gpm pumps from the brine storage tanks to the top of the softeners for each regeneration. The brine is metered and when the preset gallonage is delivered the pumps automatically cut off. The brine slug is then forced down through the exchanger media by admitting filtered water to the top of the softener and by controlling the opening of the rinse-to-waste valve to a "slow rinse" rate of approximately 200 gpm. Length of the slow rinse cycle is variable from 0 to 60 minutes with 45 to 50 minutes considered normal. Upon the completion of the slow rinse the rate controller positions itself automatically to the predetermined "rapid rinse" position allowing 1200 gpm to pass through the softener for approximately 30 minutes, although the "rapid rinse" period can be manually varied from 0 to 30 minutes and the rate changed from 1000 to 1600 gpm. Upon completion of regeneration the softener remains inactive until it is manually placed on the softening or exhaustion cycle.

The pH of the finished water may be adjusted upward with either of two volumetric soda ash feeders. These units are hand loaded with bagged soda ash. The feeders are mounted on the individual platform scales on the floor level below the feeding platform.

The softened water is discharged to either of two finished water clearwells through a blending chamber where the iron-free unsoftened water is mixed with zero-softened, iron-free water to produce a finished water having approximately four grains of total hardness but no iron. The combined storage capacity is 604,000 gallons at 16-ft. water depth.

Salt and Brine Storage and Handling

Bulk salt storage is provided in two concrete tanks which together hold 406 tons. Each tank is 14 by 51 ft. inside with a 9-foot depth of salt and an additional foot of water. Salt is delivered by trucks which dump their loads directly into the storage tanks. At a plant flow rate of 6.0 MGD, 20.3 days of salt storage is provided assuming 25-grain water softened to 4 grains hardness with 16 percent of plant inflow not being softened.

All brine handling pipe and fittings are brass. Bottom of the brine tanks contain a pump suction manifold which is overlaid with a bed of ⅛ to ¾-in. gravel varying from 8 to 16 inches in depth.

Two 35-gpm brine recharge pumps, liquid level controlled, are provided to move brine from the salt storage tanks to the 7850-gal. brine storage tank located near the softener units. The brine storage capacity is slightly more than that needed for the regeneration of three softeners.

Two 240-gpm pumps deliver brine from the brine storage tank to the individual softeners during the regeneration cycle of operation. The pumps are controlled by a batch type brine meter which is actuated at the proper place in the softener regeneration cycle.

Other Facilities

Wash water for backwashing the iron removal filters and the softeners is obtained from elevated storage, refilled by 1000 gpm wash water pumps which take suction from the filtered water clearwell. The wash water is stored in the 75,000-gallon steel elevated tank within a depth range of 21.18 feet. Tank overflow is 68.8 feet above the wash water gutters in the filters.

Shop area; laboratory; compressor and vacuum pump areas; toilet and shower facilities; chlorinator room; electric switch gear center; superintendent's office; operator's office and graphic panel center; and future fluoridation room are provided to supplement the major process descriptions already described.

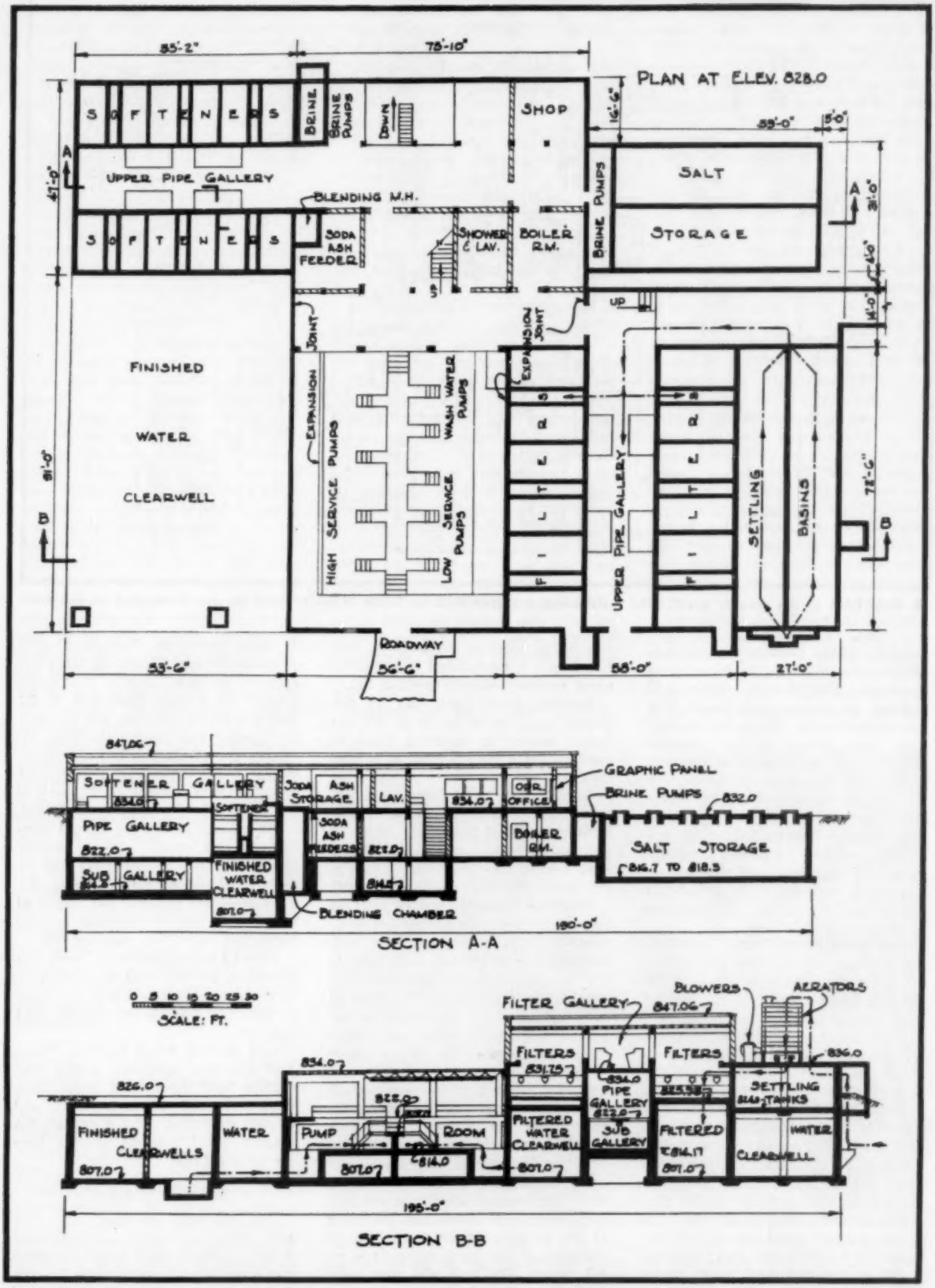
Both pipe galleries feature two levels of operation provided by an intermediate floor upon which is located the rate controllers, valves and controls, etc., with special attention given to accessibility on the intermediate level for ease of operation and maintenance.

Instrumentation

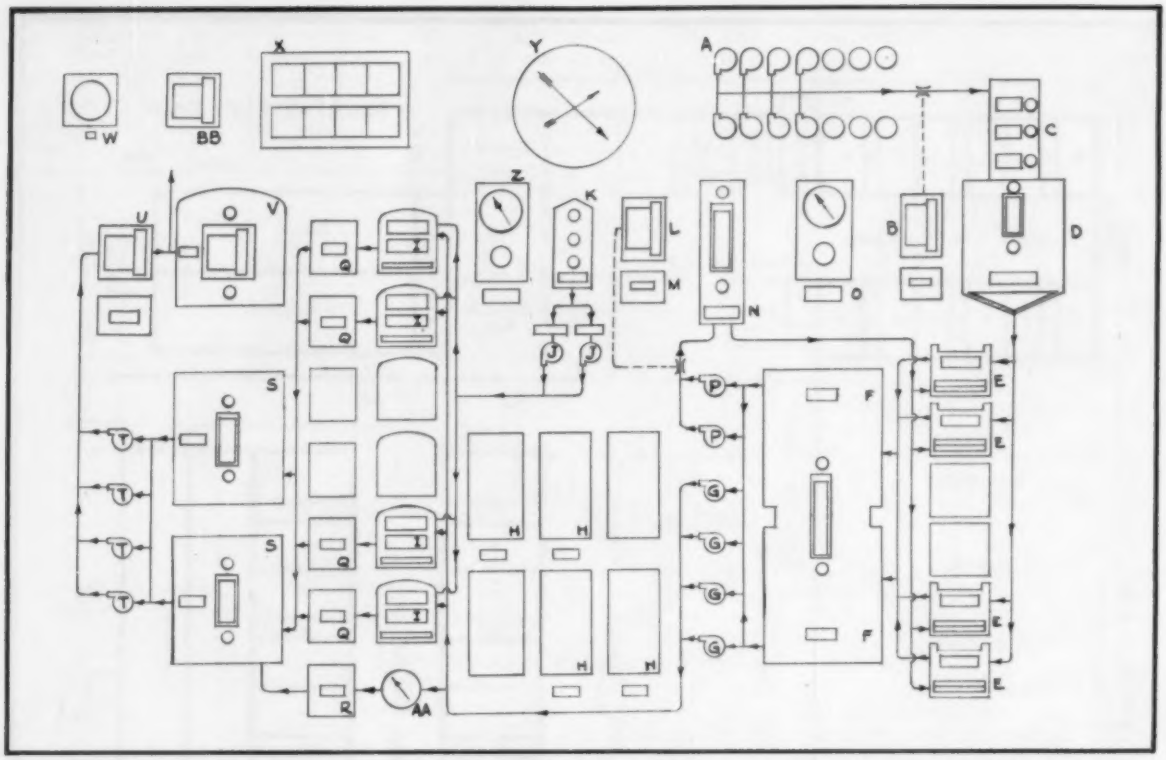
Plant instrumentation was designed for one man per shift manual, not automatic, control. Semi-automatic features are provided as an aid to efficient and continuous operation with a minimum number of personnel.

Since the various instrument manufacturers would not accomplish instrumentation with identical equipment or methods, specifications for this phase were written principally as functional rather than wholly detailed. All instrumentation and control facilities regardless of source had to be furnished by one manufacturer who was required to post a three-year equipment maintenance bond to the City.

Rate and level instruments are provided which indicate, record and totalize for continuous efficient plant operation. A graphic panel is provided in the plant office and acts as a nerve center of plant control. The whole treatment process is delineated in such a manner that the operator on duty knows exactly what the plant is doing without leaving the central office. When it is necessary to change a process, to wash a filter, to regenerate a softener, to start a pump, or to accomplish any other change the operator



● **SECTIONAL layouts show the compact arrangement of the plant and convenient location of softener and filter control areas.**



● **DIAGRAM of the graphic panel. The instruments are identified by letter symbols keyed to the description in the text.**

must go to the various control centers in the plant to perform these functions. The changes made will register on the graphic panel. The one exception to this is the master filter rate setter on the graphic panel which is controlled entirely at the panel. Compressed, clean, dry air is used as a medium for operating and controlling valves. All flow rates are controlled by air actuated rubber seated butterfly valves. A description of the instrumentation follows, with letters in parenthese keyed to the diagram at the top of this page.

Raw Water Pump Control. Individual well pumps are provided with hand-off automatic selector switches on the electric control panel. It is intended that most of the time the pumps will be on manual control. Those that are on automatic control will be turned on or off by liquid level control in the settling tank. This control is set to actuate audible alarms and warning lights at high-and-low tank levels 1.5 feet apart. Well pumps are controlled within a 1.0 ft. range for high-and-low level depths in the same tank. The pumps operating show as lighted pilot lights on the graphic panel **(A).** Eight pumps are delineated and space is provided for 6 future well pump symbols.

All of the raw well water passes through a venturi type flow sensing device before entering the aerators. This flow signal is transmitted to a graphic panel recorder-indicator-totalizer **(B).**

Aerators. Pilot lights **(C)** on the graphic panel show which of the two aerator blowers is operating. Space is provided for a third symbol at a later date.

Settling Tank Level Control. A pneumatic bubbler pressure sensing element is used to detect level fluctuations in the settling tanks and transmits liquid level information to the depth indicating symbol on the graphic panel **(D).**

Filtration Control. Each of four filters is provided with a filter operating console, which houses the filter control instruments needed. Light signals on the graphic panel indicate when each filter is operating **(E).** Rate of flow indicators for the filters in operation and master filter rate setter **(O)** are provided on the graphic panel.

The filter consoles have rate-of-flow and wash water flow indicator-controllers, each equipped with a manual-automatic selector switch (cascade control) which provides for manually setting the desired rate of operation. All operations associated with removing a filter from service, washing it and putting it back in service are controlled at the console, except the automatic stopping of the wash water tank refill pumps. The unit will then automatically match, by means of butterfly valve controllers, the rate of flow or backwash rate depending upon the cycle of operation. Loss of head is indicated on a gage reading 0 to 12 feet. Pneumatic switches are provided for opening and closing the filter influent, drain, wash water and filter sweep valves. Green and red pilot lights indicate whether or not each of the above valves is properly positioned.

Wash water pumps are started manually at the central electric control panel, with flow recorded **(L)** and totalized **(M)** on the graphic panel. On-off signals are provided **(P).** Depth of water in the tank is indicated; and-low lights and alarms are provided **(N).**

Filtered Water Clearwells. These two clearwells are equipped with depth indicators registering on the graphic panel with high-and-low level alarm and light **(F).**

Low Service Pump Controls. These four manually controlled pumps take suction from the filtered water clearwells and pump to the softeners and by-pass controller. Pilot lights on the graphic panel indicate whether they are on or off **(G).**

Softener Controls

The presently equipped four softener units are provided with individual control consoles which house the pneumatic and electric switch gear for control. Softening rates, slow and rapid

rinse rates and backwash rates are indicated on each softener console. Pneumatic valve switches with position lights, brine pump "start-stop" push buttons, "Exhaustion-Manual-Regeneration" selector switch and electric timers for slow and rapid rinse cycles are included in each console.

Basically the softener units are designed to be manually operated; however, automatic regeneration by time and rate control frees the operator for other duties and insures uniform regeneration which produces repeatability in exhaustion runs. Indicating instruments on the graphic panel show whether a softener is exhausted or is in the regeneration cycle **(I)**.

Balancing Flow. When a softener is being regenerated or when the rate of finished water production is altered, the rates of the active softeners must be changed to conform to the new rate of water production. When a softener is taken out of service for regeneration three softener rate changes take place for the remaining active softeners. Liquid level control equipment is utilized automatically to establish and maintain equal and uniform softener rates. When the water level on the softeners begins to rise, the effluent control valves are automatically opened to compensate or correct the rising water level. On receding liquid levels the softener effluent control valves throttle to maintain the set liquid level. A controlling valve in the main softener influent header provides additional liquid level control. Thus, during regeneration of a unit, change in low service pumpage, or with one or more softeners out of service, the flow rates through the individual remaining active beds are maintained equal. Signals from differential producers in each softener effluent line are balanced to divide the flows equally. The sum of the softener effluent rates is balanced with a rate signal in the hard water bypass line to maintain a preset percent of softened to bypass water. A totalizer **(R)** on the graphic panel records by-passed water flow, and a bypass ratio controller is provided **(Z)**.

Signals transmitted to flow rate indicators in the console, to individual totalizers in the graphic panel **(Q)** and to counters in the graphic panel for actuating both a visual and audible alarm **(W)** when a preset volume of water has passed through each softener.

Manual operation of the three position (Exhaustion-Manual-Regeneration) selector switch on each softener console places the functioning of the unit under the level control equipment in the softening or exhaustion cycle, prepares the softener for manual control, or places the unit under the preset time, rate and sequence of regeneration, respectively.

Softener Rinsing. Differential producers and controlling valves in each softener rinse-to-sewer line maintain preset rates of slow rinse and rapid rinse. Rate of rinse is indicated on the softener console. Two electric timers, a differential producer and controlling valve in the wash water header from the elevated wash water tank common to all softeners provide the rate of backwash indication and manual control necessary to backwash the resin beds.

An interesting problem developed in connection with the primary metering device on the waste-to-sewer line for the softeners. The flow sensing mechanism is an insert Venturi flow tube installed in a vertical run of pipe with flow downward. The high pressure tap for the differential created by the flow tube was made in the usual position which was in this case affected by an accumulation of brine trapped behind the entry cone. Because of the difference in density of brine and water the meter would creep or indicate false flows which affected the slow and rapid rinse rates. This difficulty was not encountered with this same differential producer when it was installed in a horizontal run. It is being corrected by purging the high pressure tap and low pressure tap with plant water to clear the line.

Regeneration Cycle. The regeneration phase is initiated manually, following manual backwash of the resin bed. Once initiated, the saturated brine is pumped into the softener through a batch meter with an adjustable preset volume control, the slow rinse and rapid-rinse cycles, both with adjustable and preset rates and time, are completed in sequence. At the conclusion of the semi-automatic regeneration cycle, the unit remains out of service until the selector switch is manually positioned from "Regeneration" to "Exhaustion." During the regeneration cycle, back lighted panels on the graphic panel **(X)** keep the operator informed of the phase and stage of regeneration. On-off indication for the brine regeneration pumps **(J)** and level indication in the brine storage tank **(K)** complete the instrumentation on the graphic panel for the softening cycle.

Semi-automatic features of the regeneration cycle were designed to insure repeatability of the brining and rinsing operations. Because softening capacity and salt efficiency are dependent upon how these processes are carried out it was deemed important that they be designed so they were automatically completed, at preset rates and times, once initiated by the operator.

Finished Water Clearwell. Softened and iron-free bypassed water are blended in a chamber at the entrance to the two finished water clearwells. Water levels in the clearwell are indicated on the graphic panel **(S)** and

● **OPERATING floor level view showing, at the left, the filters and switchgear panel; straight ahead, the chlorine room; and immediately to the right, the operator's room. The open stairwell provides visibility directly into the pump room below. The arrangement and choice of materials contribute a pleasing environment.**

● **SOFTENER gallery is shown at the left with a control console at the right. Each console is equipped with indicators for effluent, rinse and wash water flows; timers for slow and rapid rinse; and actuating buttons and knobs to control the valves.**

high-and-low level lights and alarms are actuated at 16 and 6-foot depths respectively.

Chlorination, Fluoridation and pH Control. Signals from the softener bypass differential producer automatically adjust the soda ash feeder and the chlorinator to feed the two respective chemicals in proper preset proportions to the flow entering the finished water clearwell. The fluoride feeder, when installed, may be controlled by this same signal.

Wash Water Tank Control. A Bourdon tube sensing element and transmitter indicate the depth of water in the wash water tank on the graphic panel symbol **(N)** which also provides high-and-low level lights. Rate of flow transmitted from the primary differential producer in the wash water line is recorded and totalized on the graphic panel **(L, M)**. This same rate is indicated on the filter and softener control consoles.

Elevated Storage on the Distribution System. Water depth in the open storage reservoir located on the top of a hill, approximately 1¾ miles from the water works, is presently being sensed in a 12-in. pipe with a Bourdon tube. The depth signals are transmitted to the plant by telemetering equipment over a leased two-wire telephone circuit. The electrical signal is converted to a pneumatic signal and water level is recorded at the graphic panel **(V)**. High-and-low level lights are also provided. Some difficulty in the accuracy and reliability of the indicated depth has been attributed to the location of the tap in the 12-in. pipe line. To insure accuracy the installation of a bubbler system in the reservoir, using nitrogen gas is being considered. Distribution system pressure is indicated and recorded **(BB)**.

High Service Pumps and Finished Water Control. Finished water flows to the distribution system through a differential producer in the common pump discharge line and flow is indicated, recorded and totalized on the graphic panel **(T, U)**. High service pumps are turned off and on manually at the central electrical control panel.

List of Equipment and Manufacturers
Lancaster, Ohio, Water Treatment Plant

Forced Draft Aerators	General Filter Co.
Fiber Glass Wash Water Troughs	F. B. Leopold Co., Inc.
Filter Underdrains	F. B. Leopold Co., Inc.
Filter Sweeps	Palmer Filter Equipment Co.
Low Service, High Service and Wash Water Pumps	DeLaval Steam Turbine Co.
Electric Motors for Pumps	Ideal Electric and Mfg. Co.
Resin	Nalco Chemical Co.
Softener Underdrains	F. B. Leopold Co., Inc.
Instrumentation and Control Equipment	Minneapolis-Honeywell Regulator Co.
Butterfly Valves	S. Morgan Smith (now Hydraulic Div. of Allis-Chalmers Mfg. Co.)
Cone Check Valves	S. Morgan Smith (now Hydraulic Div. of Allis-Chalmers Mfg. Co.)
Brine Pumps	Weinman Pump Mfg. Co.
Electric Control	Westinghouse Electric Corp.
Chlorinator	Fischer and Porter Co.
Soda Ash Feeders	B-I-F Industries, Inc.
Gate Valves	M & H Valve & Fittings Co.
Wash Water Tank	Pittsburgh-Des Moines Steel Co.
Mono-Rail Trolley & Hoist	Robbins and Myers, Inc. and American Monorail Co.
Instrument Air Compressors	Quincy Compressor Co.
Pump Primers	Valve and Primer Corp.

General

Cost of the new water works proper was $1,400,000 or $46.00 per capita served. Instrumentation and process control represents 6 percent of contract cost. The plant is owned by the City of Lancaster represented by Ernest D. Deeds, Superintendent of Water. Contract construction was carried out under the joint venture of C. Ray Sykes and Don King Construction Company. Burgess & Niple, Consulting Engineers designed and supervised construction of the plant.

DEVELOPMENTS

In Highway Maintenance Equipment

JAMES E. BELL
Equipment Engineer
Bureau of Maintenance
Illinois Division of Highways
Springfield, Illinois

IN ILLINOIS, highway maintenance equipment requirements have seen some significant changes in recent years due to improvements in maintenance procedures and the increasing maintenance obligation generated by the modernization and expansion of our State and Federal highway system.

Our equipment needs are based on the following general maintenance activities: 1) Maintenance of Portland cement concrete surfaces; 2) maintenance of bituminous concrete surfaces; 3) shoulder and ditch maintenance; 4) roadside maintenance (becoming more commonly referred to as landscape maintenance); 5) snow removal and ice control; and 6) bridge maintenance.

Major developments and improvements in maintenance equipment have been generally limited to that equipment used for roadside or landscape work and for snow and ice control operations. This does not imply that improvements are not needed for equipment used in other maintenance activities, because many would be desirable, but in Illinois most of our efforts have been directed to mowing equipment and snow and ice control equipment.

In mowing equipment, improvements in the design of and more widespread use of hydraulically-powered sickle bar mowers, and increased use of rear-mounted rotary mower attachments, have been the trend. Illinois recently purchased and put to experimental use, gang-type hammer-knife mowers. Large tractors with 8-ft. center-mounted rotary mowers and a 15-ft. three-section pull-type rotary mower have also been added to our equipment list. Two of the more encouraging developments with tractor mowers have been: The successful use of a four-wheel-drive tractor, equipped with high flotation tires and a hydraulically-powered rotary mower for mowing 2 to 1 slopes; and the successful use of the 8-ft. center-mounted rotary and 15-ft. pull-type rotary mower in areas where large expanses of right-of-way are encountered.

There is much opportunity for further improvement in highway mowers. For years, many highway maintenance forces have used mowers which have been adapted for highway work from existing agricultural equipment. Any mower having a large quantity of exposed moving parts represents a potential maintenance problem. All rotary mowers need improvement in preventing the discharging or throwing of debris and in better distribution of the cut vegetation.

In order to accomplish our mowing as efficiently and economically as possible, there is a need for units which produce a greater production rate. This possibly can be accomplished by faster mowing speeds and/or by mowing wider swaths. Swath widths, however, are limited by the maneuverability of the mowing equipment and the quantity of sign posts, trees, shrubs, etc. in the right-of-way. Our experiences have also indicated that before higher speeds can be utilized, there is a need for improving the condition of the typical right-of-way turf in order to eliminate bouncing due to rough ground conditions.

The rough ground problem also indicates a need for equipment which can be used for rehabilitating and maintaining the condition of the right-of-way. Roughness is most prevalent during the first few years following new construction and is going to be a major problem in connection with the early maintenance of our Interstate Highway System. Equipment developments required for improving landscape maintenance operations consist of better seeders, improved disc and harrow attachments and better fertilizer and mulch spreaders. This type of equipment is needed for improvement of ground conditions at the time of construction and in maintenance operations following construction.

In our snow and ice control operations, new equipment developments have included hydraulically-powered replacement-type end-gate spreaders, hydraulically-powered hopper body spreaders and power-reversible trip-blade snow plows. Most of these improvements have

● **TANDEX-AXLE truck, capacity 12½ cubic yards, has spreader which is power-driven by an auxiliary engine. A 12-foot reversible snow plow mounts on the front.**

● THIS is a 1960 IHC tractor with Danco 8-foot center-mounted rotary mower. The chain curtain shown at bottom has been effective in controlling throwing of debris.

● MOWER team, utilizing hammer knife mowers, permits mowing a wide swath, but its usefulness may be limited by maneuverability and presence of obstructions.

● SPECIAL flotation tires and side-mounted hydraulically powered rotary mower can be used on slopes of 2:1. Special rear wheel prevents "digging in" on reverse.

been aimed at making the job easier and safer for the maintenance equipment operator by eliminating the need for leaving the truck cab to operate or adjust the spreader or snow plow. Generally speaking, we are well satisfied with the performance of the end-gate spreaders. We do believe, however, that hopper-body spreaders could be improved in the methods used for delivering materials to the spinner discs.

Requirements for snow plows have been changing due to highway modernization resulting in improved grades and cross sections, additional construction of multiple lane highways and increased use of chemicals. We are beginning to increase the width of our plows, using more 11 and 12-ft. moldboards. While we have been able to increase our plowing speeds somewhat, we feel that recent snow plow design changes are not the complete answer. Due to the heavy traffic volumes on most of our highways, it is our opinion that high-speed plowing, such as is employed in airport work, will never be permissible in highway snow removal operations. It appears, as of this date at least, that one answer to multiple-lane plowing is simply more units grouped for tandem plowing.

One of the most serious problems in connection with snow plows is the need for design standardization among the manufacturers and governmental agencies. This is particularly true in the case of dimensions of hitch assemblies. We have frequently experienced a need to be able to connect one manufacturer's snow plow to another manufacturer's push frame. As long as there is competitive bidding on snow plow requirements for governmental agencies, there will be a need for this form of standardization. In view of the excellent results obtained through standardization of bolt-hole spacing for plow cutting edges, it would certainly seem desirable that similar steps be taken in respect to hitch dimensions.

Both new equipment developments and improvements in existing equipment are needed to properly meet the demands of modern highway maintenance operations. One important factor, not to be overlooked in any equipment design, is the need for simplicity. Equipment, to be of greatest value, must be made so that it can be operated and cared for by the average highway maintenance employees without excessive training or technical skill.

GROUND FAULT LOCATOR PROTECTS AIRPORT LIGHTS

CONTINUED modernization of facilities at Chicago's Midway Airport includes a system which allows ground faults that develop on runway and parking lighting systems, to be located quickly with pinpoint accuracy. This new system offers several advantages: Faults can be located quickly and easily; faults can be removed soon after developing so lights need not be out of service at all, or only for short periods; and faults can be located without trial-and-error disconnecting of circuits or unnecessary digging.

Airport runway lighting circuits are similar in installation, whether of series loop or multiple parallel design. The power distribution cables from the substation feed the various transformers located throughout the field. Individual lamp transformers are housed in small concrete pits flush with the ground. The runway light is mounted above the pit. The cable for the lighting circuit enters the pit and passes through the primary of a transformer to the other side of the pit, and on to the next light. Depending on the type of system installed, there may be more than one transformer per pit. The cable is generally a direct burial type and is buried from one to three feet below the surface of the ground.

The pits collect water during rainstorms and when these storms are severe or frequent enough to keep the transformers continually submerged in water, trouble is bound to develop and the transformers or other parts of the system will go to ground. These grounds can be severe enough to allow the complete system or portions of it to become inoperative so they must be located and removed quickly.

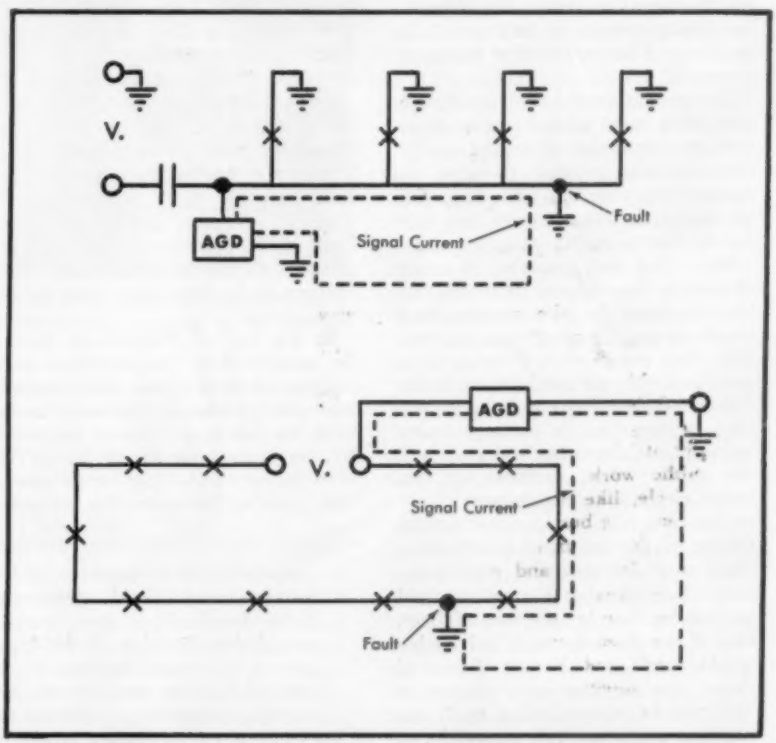
The usual method is to de-energize the system, then open the cable at various points and check for grounds by ringing out the cable between these points. This takes considerable time and there is always a good chance that an improper insulation closure may cause another ground.

The new fault-locating system (called the Allen Ground Detector, manufactured by the Excel Electric Service Co., Chicago, Ill.) can be applied to both series and parallel circuits. It consists of a signal generator and a hand-held signal receiver. The signal generator in the substation is connected to the circuit to be tested. When the instrument is energized and a ground fault is present on the circuit, a signal current will flow. The signal current pulsates in a distinctive manner and is traced by the operator at ground level with the signal receiver by observing the signal pulsations on the signal receiver meter. The signal is traced to the fault. If the fault is of a pinpoint nature, the signal will drop sharply at that point. If the fault consists of a damaged length of cable, the signal falls off gradually over the damaged length. The fault is then exposed and the system put back into operating condition. The location time has been a matter of minutes.

● **GROUNDS in airport runway or parking lighting systems can be located by ground detector system very quickly.**

The Allen Ground Detector System has been in use for the past ten years by industrial plants and railroads to locate faults on both energized and de-energized circuits.

The Atlanta Municipal Airport in Atlanta, Ga., was the first airport to use the system to maintain its runway lighting circuits and was soon followed by the Midway installation. Both airports have found that this system offers an easy, effective way of locating ground faults, saves time in location, eliminates the necessity of opening and re-splicing cable, saves useless digging and, most importantly, insures maximum circuit reliability and safety.



● **UPPER PORTION of diagram shows application of ground detectors to system of parallel circuits. Lower diagram illustrates application to series lighting systems.**

Fitting the Highway Into the Urban Plan

ELLIS L. ARMSTRONG
Commissioner of Public Roads
U. S. Department of Commerce
Washington, D.C.

ANYBODY who decides where a highway is to go is to some degree committing his community to a comprehensive plan. It is the highway that in great part determines the use to which the land area it serves is to be put—trade, industry, homes, recreation, or what not. A road is both effect and cause; it is the effect of present demand and a cause of future growth.

Building a highway before a community plan is adopted is a little like building a hallway without any blueprints for the structure that is to go around it. As people walk through the hallway it may seem proper to cut doors here and there and to add rooms. But what purpose are the rooms to serve? Are they to be sitting rooms or bedrooms? Is this to be a home, an office building, a school?

The people should first determine what they want to make of an area and use the highway as one of the tools to achieve that purpose. A modern highway can be a beautiful and highly functional thing, but it is not an end in itself.

The need for planning is most obvious in the city and its surrounding counties, for the metropolitan areas are rapidly growing in population; they are growing even faster in area, and old relationships are being dislocated. In many cases the second ring of counties is already being brought into the urbanized area, and the public works engineer on this outer circle, like his fellows closer to the center is busy estimating the effects of the influx of new industries, new families and new commercial services on his county, and is studying how to take care of them. One of the chief demands is for adequate roads and streets. Some of these new developments cannot or will not be accomplished until the highway improvements are made.

In the 1920's the city was the neglected stepchild of the highway program. The early Federal highway acts and many State highway laws prohibited the expenditure of funds for improvement of urban connections. The principal reason was that the cities had all-weather street surfaces while farm roads were mud. In 1944, a Bureau of Public Roads' report to Congress on "Interregional Highways" recognized that conditions had changed. "With congestion of the transcity routes replacing rural highway mud as the greatest of traffic barriers," it said, "emphasis needs to be reversed and the larger expenditures devoted to improvement of the city and metropolitan sections of arterial routes." The report pointed out that the route locations were a matter for joint agreement among the Federal, State and municipal authorities.

The "interregional" system that the Bureau recommended in 1944 has become the National System of Interstate and Defense Highways. The emphasis has indeed been changed, for according to present estimates 42 percent of the cost of completing the system will be for urban highways. And the need for coordination is greater than ever. The same traffic flow frequently runs through three jurisdictions—city, county, and State—with the Federal Government an active partner of the state highway departments in developing the highway system.

In the use of Federal-aid funds for roadbuilding, the initiative and responsibility for the development and construction of highways rests with the States, subject to approval by the Bureau of Public Roads in accordance with the regulations laid down by Congress. The law provides broadly that the Interstate System "shall be so located as to connect by routes, as direct as practicable, the principal metropolitan areas, cities, and industrial centers, to serve the national defense, and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico."

The growth of metropolitan areas often involves not only cities, counties and other authorities but more than one State, and sometimes a Federal jurisdiction. The responsibility for administration and engineering in these complex areas is usually divided, so that it is not possible to go to a single man behind a desk and expect to get an over-all program and definite decisions. It is a matter for many coordinating groups to work out. For example, in the 192 standard metropolitan areas, as defined by the Bureau of the Census, there exists 951 separate county and municipal governments. These all have some degree of responsibility over highways within their boundaries. Thus there is need for real action and decision as to community plans.

Guidelines for Planning

From the standpoint of the roadbuilder—and indeed, I believe, from everybody's—the broad view and the long view are best. In laying out an urban highway system, the engineer needs guidelines for many years ahead. Are, for example, the functions of the central business district changing, and will the city be best served by centralization or a dispersed-central arrangement? Can dispersal ease the traffic burden?

Secretary of Commerce Frederick H. Mueller recently accepted the resignation of Ellis L. Armstrong as Commissioner of the Bureau of Public Roads, U. S. Department of Commerce. The Commissioner has served since October 13, 1958, as second in command to Federal Highway Administrator Bertram D. Tallamy in administering the vast Federal-aid highway program in the U. S. and its territories. Mr. Armstrong's resignation is effective early this month when he will become President of the Better Highways Information Foundation, a private non-profit organization devoted to national highway education.

It is impossible to present a fixed pattern for the future and say, "Boys, this is it!" The further ahead you push the date for which you are making a plan, the less definite it can be. Private decisions over which the planner has no control may make alterations necessary before it gets to the action stage. It is desirable to have a long-range plan, not too detailed but under constant review and revised as necessary. From such a plan determinations can be made for the action program for today's fulfillment.

What should a comprehensive plan include? It seems to me that the Connecticut statutes, in prescribing city planning, offer a good example. For this information I am indebted to James S. Klar of the Connecticut Development Commission, who summarized the provisions at a Yale traffic engineering conference last year.

The responsibility for city planning is vested in a commission of laymen, serving without pay, who, with the advice of a full-time staff or professional technicians on a consulting basis, are required to prepare a plan of development for the municipality. This plan should show "the most desirable uses of land for residential, recreational, commercial, industrial, and other purposes; the most desirable densities of population in the several parts of the municipality . . . provision for airports, parks, playgrounds, and other public grounds; recommendations for the general location, relocation and improvement of public buildings; for the general location and extent of public utilities and terminals; and for the extent and location of public housing projects."

This plan, the statutes say, "shall be based on studies of physical, social, economic and governmental conditions and trends and shall be designed to promote with the greatest efficiency and economy the coordinated development of a municipality and the general welfare and prosperity of its people."

Such a plan is a tall order to fill, and takes time. Small wonder then that the administrator and engineer often have to content themselves with less elaborate guidelines. If there is no comprehensive plan, next best is an over-all transportation plan, including not only highways and streets but means of mass transportation of goods and people by rail, pavement, water or even air.

If there is no over-all transportation plan, at least a current and realistic urban arterial highway plan is a prime need from the standpoint of the highway engineer. Last November I asked the Bureau of Public Roads field offices to work with the State highway departments and cities toward the objective of completing such plans where they did not exist and updating others that were no longer current. At the Washington headquarters of the Bureau, an Urban Highway Division has been established in the Offices of Engineering to furnish technical aid and cooperation.

● **CONGRESS Street Expressway, Chicago, is constructed with eight lanes for motor traffic while providing for two lines of mass transit rail facilities in the median.**

State and Urban Cooperation

The American Association of State Highway Officials and the American Municipal Association have for some years strongly urged close cooperation between State and urban officials in each city with generally good results all across the nation. The division (State) offices of the Bureau of Public Roads are participating in this cooperative effort.

Highway officials had for years been struggling with the problem of coordinating urban planning and highway planning—and with notable success in some areas. The Sagamore Conference of October, 1958, brought municipal and highway officials together and gave new impetus to the efforts of both to achieve a cooperative approach to planning. The meeting was formally called the National Conference on Highways and Urban Development, and was held at the Sagamore Conference Center of Syracuse University under the sponsorship of the Joint Committee on Highways of the American Municipal Association and American Association of State Highway Officials, the Committee on Urban Research of the Highway Research Board (National Academy of Sciences-National Research Council), and Syracuse University.

It was attended by 55 top highway officials, mayors, public works directors, city planners, traffic engineers, transit officials and business and civic leaders.

In its findings, the conference recognized that the highway program in the States and local communities had benefited greatly from the historic and proven relationship existing between the Bureau of Public Roads and the state highway departments, and that the prime responsibility for implementing the state highway programs, including the Interstate System, and completing them within the prescribed time, lay with the States.

The conference recommended that the state highway departments work with local authorities in planning, designing, constructing and operating streets and highways in local areas. Specifically, it urged that the highway departments develop cooperatively a tentative program of urban highway improvement for at least five years in advance as a basis for local planning. This program, it said, should be in accordance with a jointly agreed upon long-range plan.

In cases where local government had not initiated community planning, the conference recommended that the State take responsibility for starting it. The conference felt, however, that the primary responsibility was local, and that the local government "should prepare a comprehensive plan for the physical development of the community, embracing a land use plan, a transportation plan including public transit, and a program for land use controls." Regional planning should be initiated in every metropolitan area.

The Sagamore conference urged as a basis for planning, studies by all agencies to develop the necessary facts and, in the area of transportation planning, highly recommended the procedures set forth in the guide and manuals of the National Committee on Urban Transportation. The committee comprised representatives of the American Municipal Association, International City Managers' Association, American Society of Planning Officials, National Institute of Municipal Law Officers, American Public Works Association, Municipal Finance Officers Association, Bureau of Public Roads, Canadian Federation of Mayors, and the National Association of County Officials.

The guide, entitled "Better Transportation for Your City," has been endorsed by the AMA-AASHO Joint Committee, for the American Transit Association, the Bureau of Public Roads, and other national organizations. Copies of the guide, and of a series of supplementary manuals for technicians, may be obtained from the Public Administration Service, 1313 East 60th Street, Chicago 37, Ill.

Many of the studies outlined in the guide are of a type eligible for Federal-aid participation as part of the program of engineering and economic investigations in connection with highway planning, financed with the 1½ percent of Federal-aid highway funds available for this purpose if submitted by the State as part of such a program.

● **GREATER New Orleans bridge and Pontchartrain Freeway bisect New Orleans. In center is Mississippi River and business section of City; Lake Pontchartrain in rear.**

The guide itself was designed for use by mayors, city managers, city councilmen, transit officials and state highway engineers. The 17 procedure manuals were intended for use by field personnel in conducting recommended detailed studies. These were field-tested, beginning in 1956, in seven cities: San Diego, Calif.; Phoenix, Ariz.; Detroit, Mich.; Syracuse, N.Y.; Albuquerque, N.M.; Oak Park, Ill.; and Pocatello, Idaho. When the National Committee on Urban Transportation decided in May 1960 to disband, as its objectives had been fulfilled, it announced that more than 150 communities had indicated an interest in adopting the program. Nashville and Chattanooga, Tenn.; Joplin, Mo.; Dayton, Ohio; and Salt Lake City, Utah, among others, were already proceeding with it.

Salt Lake City and its neighboring towns and counties are making effective use of a Citizens' Advisory Committee in a two-year transportation study that will cost about $500,000. The NCUT guide stresses that such a committee serves as a spearhead for public support and that whether an improvement plan will stand or fall depends largely upon the degree of understanding and acceptance that is generated among the citizen body. "An essential step, therefore," says the guide, "is the formation of a strong support group drawn from various civic, service, safety, traffic and parking organizations, and including leaders of business, industry, labor, farm, and professional groups."

At the invitation of Governor George D. Clyde of Utah, 22 civic leaders have formed such an Advisory Committee for the Salt Lake City area. The official planners who are doing the technical work look to the members of the committee to explain the study to the public and to carry back to the engineers word of what the citizens think about it. The effectiveness of the committee is already being felt.

Nationally, although the NCUT itself has disbanded, continuity will be provided by the American Municipal Association (1612 K Street, NW., Washington 6, D.C.) which will have a technical consultant to aid cities in organizing and initiating studies of the type recommended by the Committee. The consultant will not be available to direct or supervise individual studies but will help to get them started and to give general advice.

Facts For Planning

In preparing a transportation or urban arterial highway plan, the great need is for facts. They form the basis for the determination of trends, the estimates of future conditions and the reconciliation of divergent views. The procedure, which is outlined at length in the

guide and manuals prepared by the National Committee on Urban Transportation, includes these studies:

Street Use. Streets are usually assigned to four categories: Expressways, major arterial streets, collectors or distributors, and local streets. Each category can be indicated on a map in a distinctive color.

Travel Habit (Origin-Destination) and Land Use. A travel habit study develops information on the number of trips into, within, and through the city, the origin and destination, the mode of travel, and trip purpose. For urban areas under 5,000 population, a simple external survey by a cordon of interviewers is usually enough. For urban areas between 5,000 and 75,000, a similar survey or a combination with an internal cordon survey, a parking survey or a home interview survey is recommended. For larger places, the external cordon and home interview survey method is preferred. According to a recent count, over 160 home interview transportation studies had been made in 28 States.

Land Use. Data on land use are essential for the development of an over-all land use plan, which logically should precede or parallel a transportation study. Furthermore, to project traffic patterns with reasonable accuracy, it is necessary to determine the relation between various land uses and traffic generation. In other words, anticipated land use provides a basis for estimating future travel patterns.*

Existing Traffic Service. The general subject may be covered in half a dozen studies. Traffic volume, travel time, street capacity, accidents, parking, and control devices.

Existing Transit Service. The component studies include routes and coverage, transit route inventory, passenger load data, service frequency and regularity, transit running time, transit speeds and delays, general operating data and passenger riding habits.

Physical Street System. An inventory of existing street details is a necessary tool for making decisions on their adjustments and improvements.

In addition to facts about transportation facilities and habits, financial data can be assembled in convenient form for administrators and legislators.

Getting the facts is only one step, of course. After they are in hand, the problem must be defined, the planned improvements determined, the best transportation and financial programs must be adopted, and they must be carried out. But the facts lay a foundation on which the planners can build.

*Page 16 of *Better Transportation for Your City*, the Guide Manual of the National Committee on Urban Transportation.

Making Forecasts

In making forecasts, a time twenty years off may well be chosen In the 1956 Act, however, Congress prescribed specific designs adequate for 1975 traffic for the Interstate System, but there is no magic in that year and a later date may well be used for today's general planning. Indeed San Diego, one of the pilot cities, chose a "horizon year" that is not an exact calendar date at all, but the year when the metropolitan area will reach 2.4 million in population.

In outlining an expressway system for the horizon year, whatever it is, there are broad questions of geometric pattern that may require a joint effort of planner and engineer. Shall the system, for example, be circumferential and radial, with highways placed like the rim and spokes of a wheel, or shall it take advantage of the grid pattern of streets and approach the city center along the sides of existing rectangles? Can this latter concept be tied to the relief of traffic congestion by means of dispersing traffic generators? And will such a solution provide for a more economic use of land and the avoidance of the diagonal chopping up of rectangular plats?

Highway planning must take into account all kinds of roads, but the Interstate System brings its own problems. The 41,000 miles of the System will link 90 percent of the mainland cities with populations of 50,000 and more. It is being designed for the types and volumes of traffic expected in 1975. It is not the entire answer to urban transport problems but rather the basic skeletal frame for a complete urban or regional system. Any new arterial highway or freeway should be considered as a supplement to the existing system of streets and highways in the overall transportation system.

Although the length of the Interstate System is not impressive when compared to the total of 3.5 million miles of roads and streets in the country, it is expected upon completion to carry 20 percent of the nation's highway travel. As the System is constructed, it will increasingly stimulate long-distance trucking, bus travel and passenger car driving. The sections that have been opened show a great influence on the growth of industry, business, and home communities. As the Sys-

● **COMPLEX of transportation structures at an interchange in Columbus, Ohio. Main downtown section of the city is at the upper right. Scioto River is in the foreground.**

tem approaches completion I think we may expect public pressures for its extension, primarily in urban areas.

Urban and highway planning along the Interstate route has a special importance. A preliminary compilation made by the Bureau of Public Roads in November 1959, listed 288 cities of 25,000 population or more that were included in urban areas penetrated by the Interstate System. Over half of them had comprehensive city plans of some sort and 45 others were working on them.

Sixty-six of the 288 cities had overall transportation plans, including facilities other than highways, but 230 (80 percent) had at least urban arterial highway plans. Of the remainder, 25 cities had started arterial highway plans, and 33 had made no move.

The arterial highway plans in some cases are limited to corporate boundaries and do not cover entire urban areas. In some metropolitan areas that include a number of municipalities there may be separate plans for each municipality, or there may be no plan for one or two of them. The separate plans are not always integrated. Obviously, much planning has been done along the Interstate route and elsewhere, but there is room for further progress.

Studies and Research

Officials and engineers, in estimating the social and economic impact of highway improvements on their communities, can draw on a wealth of studies made in all parts of the United States. A Selected Bibliography on Economic Impact Research may be obtained upon request from the Economic Impact Research Branch, Highway and Land Administration Division, Bureau of Public Roads, Washington 25, D. C. Lists of studies in progress are also available.

In the acquisition of land for right-of-way, it is sometimes possible to use blighted areas, thus serving the secondary purpose of giving nearby business districts the highway access they need. I believe good examples of such operations may be found in New Haven, Conn.; Washington, D. C.; Norfolk, Va.; and Cincinnati, Ohio. Advance acquisition for right-of-way gives private developers a chance to prepare their own plans for land uses in accordance with an over-all community development program. Highway legislation permits advance acquisition of lands for right-of-way with Federal aid as long as seven years before they are needed for construction.

Industry Attracted

Freeways attract new industry. For example, an inventory of industrial development in 17 cities and towns along Route 128 (Boston Circumferential Highway) made in 1958 revealed an investment of $85 million. Development at that time consisted of 209 companies in operation, 17 under construction, 16 industrial parks, 2 shopping centers and one under construction. For comparison, there had been 39 companies in operation and 14 under construction in June 1955. Similar industrial growth has taken place in the Delaware Valley, along the New York Thruway and on freeways in Texas, California, and elsewhere.

Many retail and service businesses have come to depend almost entirely on car-borne customers and welcome new locations along major highways. Their patrons, in turn, find homesites on land that was formerly inaccessible. They also find that jobs are widely available in suburban industry and trade within range of their cars. The stimulus of modern highways extends to all segments of the economy.

Better motor transportation helps society in other ways—getting the children to school, getting the sick to doctors and hospitals, getting the police and firemen to emergencies and, of course, getting an urban population of about 120 million souls out of the city on week-ends.

An adequate highway system will not only provide indispensable traffic service and accessibility, but it can—and does—help mold desirable land-use arrangements. Those with responsibility for route selection and highway improvements are therefore accepting considerable responsibility as well, for helping to mold the economic and social life of their communities.

From the standpoint of the public works engineer, as well as of the state highway departments and the Bureau of Public Roads, it is necessary today that all agencies of government with responsibilities for highway development coordinate their activities in the preparation of effective local plans. Because of the complexity of urban highway transportation, expert engineering alone is not enough. In the initial planning phase, joint or intergovernmental cooperation is required. The initial coordination of community and highway planning is the first and most important step in the development of a sound program. Good highway design is the natural outgrowth of this initial planning process, followed by sound construction, and, eventually, by effective and reasonable maintenance. Good cooperative staff work during each phase will insure effective operation of the highway system. The failure, however, of any one phase—or the failure to accept or recognize responsibilities—will almost surely foredoom to failure the successful traffic operation of the transport system we build.

I might add that progress on action programs calls for recognition by all concerned of the distinction between the broad planning and specific design steps. While specialists in both groups should have knowledge of the responsibilities and work details of the other group, they can hamper progress if they intrude in each other's fields.

I know from conversations with municipal and other officials in many parts of the country that there is a growing realization, not only that adequate plans must be made, but that they must reflect the whole needs of the community—its economy, its housing, its culture, its recreation, its transportation. The Bureau of Public Roads, as the Federal agency concerned with highways, will continue to do whatever it can toward that end.

• • •

Equipment for the New York Port Authority

The purchase of 222 pieces of automotive equipment to meet the needs of The Port of New York Authority is planned for 1961. This will cost about $1,647,800 and will include: 12 pieces of special snow removal equipment expected to cost $397,300; 124 passenger vehicles, $286,700; 4 pieces of airport emergency equipment, $257,500; 14 heavy trucks, $202,000; and 12 road and runway sweepers, $146,500. It will also include five special purpose trucks, to cost $142,900, including two runway vacuum cleaners, two flush trucks for cleaning tunnel walls, and a high lift truck providing a work platform up to 95 feet. The balance comprises 28 pieces of miscellaneous general maintenance equipment at $118,100; 5 tunnel and bridge emergency trucks at $43,300; 10 light trucks at $29,300; and 8 police patrol and station wagons at $24,200.

● TYPICAL STORM procedure calls for pushing the snow to intersections and loading into trucks for removal during early morning or late evening.

Snow Removal Contracts and Heated Pavements Aid Boston's Winter Program

TIMOTHY J. O'LEARY
Director of Transportation
Public Works Department
Boston 8, Massachusetts

IN HISTORIC Boston, snow removal and ice control have been problems since the days of Paul Revere and John Hancock. Boston has a total of 750 miles of streets in a 43 square mile area. Most of these streets were never laid out for modern vehicular travel, a fact to which most visitors will testify. Situated in the northeastern region of the country, our climate develops a wide variation in snow fall in the City of Boston. The average snow fall is 40 in., though in the winter of 1947 it went to 90 in., dropped to 24 in. in 1953 and in 1955 it soared to 70 in.

In Boston, all snow removal operations are under the direct charge of the commissioner of public works, who is responsible to the mayor. The commissioner, for assistance in the snow season, appoints a director, three assistant directors and a number of area engineers who are responsible for all sanding, plowing and removal in their assigned districts.

If he deems it necessary, the commissioner has the authority to declare a state of emergency, due to intensity of a storm. This was necessary on Valentine's Day in 1940 when it snowed at the rate of three inches an hour for seven hours with 60 mph winds halting all traffic. It was found necessary to declare a state of emergency on March 3rd of last year when it snowed for 24 consecutive hours to a depth of 30 in., the most severe storm in 20 years.

Communications

The city has a central snow headquarters from which all orders are issued by phones especially installed in four areas and seven districts. Last winter, it was felt that the installation of teletype equipment in the area offices would prove more efficient and furnish the director with a more permanent record of his decisions. In addition, the Public Works Department has a short wave radio station operated 24 hours a day next to the central telephone headquarters. This station is in constant communication with 40 vehicles of various types scattered throughout the city and operated by key personnel of the department.

● MOST of the snow is dumped into Boston Harbor with land dumps used where long hauls would be too costly.

These cars and trucks, as well as the station itself, were procured a number of years ago through Civilian Defense and have proven of inestimable value in many emergencies such as hurricanes, major water breaks, etc., as well as snow removal operations.

The city contracts with a weather advisory service as well as using the United States Weather Bureau reports from Logan International Airport in Boston. This has often been confusing, as Logan on the ocean front may register 2 in. of snow while the Brighton district, five miles inland, may have double this amount.

The Public Works Department contracts usually for about 6,000 tons of rock salt, which is partially delivered in the fall and the balance in early winter. It is all stored in various highway districts, where it is mixed with sand. Sand is purchased under contract in the amount of approximately 24,000 tons per year.

In the downtown business district, straight salt is spread to assist in a rapid runoff of falling snow and to free the area of all snow within 24 hours after each storm. This method is expensive but felt necessary.

At the present, the city has 40 heavy-duty, 12-ton, four-wheel-

● **THE BEST of planning could not prevent this kind of scene from occurring during last winter's thirty-inch storm—the most severe in twenty years in Boston area.**

drive trucks with sand spreaders that are assigned to the task of spreading a mixture of four parts sand to one part salt during normal 2 to 6-in. storms. These trucks are all equipped with plows and may plow and spread at the same time. In addition to the 40 heavy duty trucks, the Public Works Department has 40 Ford trucks equipped with spreaders and plows.

In addition to the 80 city owned plows, the Public Works Department contracts each fall for the use of privately owned trucks of various types, to which the city attaches an A frame and plow. These trucks are then stationed in the contractors yards to be on call in the event of an emergency. When called to duty, time is allowed for attaching the blade before reporting to the district yards. A minimum of 4 hours is paid, the average rate being approximately $7.00 per hour, including the operator of the vehicle. Bulldozers and graders are allowed two hours to reach the site of operations and the rates are considerably higher, running about $17.00 per hour. Where the use of a trailer is necessary for hauling tractors, a rate of $9.00 per hour is allowed. The Public Works Department has approximately 250 plows available under this agreement assigned to the various city districts.

Snow removal in Boston is conducted under one of three different categories, based upon the intensity of the storm.

First, with city equipment. The city owns three Barber Greene snow loaders, 4 bucket loaders, 19 front end bucket loaders, 3 tractor shovels, 4 crawler tractors and 1 grader. In an average storm of 6 to 8 in., the procedure has been, after plowing, to push the snow with front end loaders to various intersections in the early morning or late evening hours. After this has been accomplished the snow is loaded into city vehicles.

Second, with rental labor and equipment. In the event that the size and depth of the storm are above normal, the city puts into effect a Force Account Agreement with contractors for furnishing labor and equipment under contract. The amount of each contract, awarded to approximately 20 contractors, will average $2,000.

In both instances, the city furnishes the dump locations and the men and the equipment necessary to operate the dumps. Most snow is dumped overboard into Boston Harbor. In a few instances, land dumps are used but are necessarily limited. Length of haul is the determining factor.

Third, under snow removal contracts. The commissioner each fall writes specifications for snow removal contracts on a cubic yard basis. This is done on an area setup. The contractor awarded the bid must agree to furnish all labor, equipment, materials, and implements necessary to remove snow from the streets within the area provided in the contract. In order for a contractor to qualify, he must furnish evidence of ownership of one or more modern wheel-mounted or caterpillar-propelled spiral-feed or paddle-feed type loaders. Such loaders are inspected by a representative of the Public Works Department before the contract is awarded.

In addition to a laborer to assist the operator of the loader, the contractor is required to furnish at least a minimum number of trucks with a combined capacity of 36 cubic yards. If the contractor uses hired trucks, he must pay not less than the prevailing rates in the area covered by the contract. One foreman must be provided with each snow loader. Computations of the amount of snow removed is made on the basis of the contents of each vehicle as determined by the employees of the Public Works Department. A load plate is made out showing vehicle number, cubic yard capacity and vehicle registration number. The load plate is stamped, upon arrival at the dump, on a receipt ticket. The average cost to the city in recent years has been approximately $1.00 per cubic yard for this type of service.

Heated Roadways Downtown

Within the corporate limits of the City of Boston, the Commonwealth of Massachusetts, with the aid of federal funds, has recently completed a six-lane express highway, the total length from the Mystic River Bridge on the north to the Smith Bridge over the Neponset River in the south being eight miles. The cost of this undertaking was $98 million not including land damages. One of the progressive features of this roadway is its 14 heated on and off ramps controlled by five pump houses and operated by underground steam supplied by Boston Edison.

This system consists of 1-in. lines placed 15 in. apart with 2½-in. feeder lines, all embedded in the concrete pavement. A mixture of 40 percent glycol and 60 percent water is circulated through the pipe lines and the pump house. The system has proven very successful in preventing any appreciable accumulation of ice or snow on the pavement and has been instrumental in eliminating many accidents.

The annual snow budget normally is $500,000. In some years that amount is not needed while in others costs may run over $1 million.

This is a condensation of a paper presented by Mr. O'Leary at the 1960 Public Works Congress in New York City.

First ZIMMERMAN PROCESS PLANT Nearing Completion

An extract from a paper on Trends in Sewage and Waste Disposal by B. A. Scheidt and E. Hurwitz, Metropolitan Sanitary District of Greater Chicago before the 1960 meeting of the American Public Works Association.

THE WET-OXIDATION or Zimmerman process is a new method of "incineration" which uses the principle of wet combustion to degrade the organic matter in sludge. Basically the process is chemical oxidation, under pressure, of combustible materials in water solution or suspension. Atmospheric oxygen is the oxidant and the organic matter of sewage sludge, or any organic substances for that matter, is the combustible material. Oxidation will occur at temperatures around 300°F. and will be more efficient between 400°F. and 650°F.

The mechanical features of the system consist of two prime movers, a pump and a compressor, a reactor and a series of heat exchangers. Sludge preheated to 180°F. is pumped to a storage tank. A feed pump operating at 30 to 50 psi delivers it to a high pressure pump operating against a pressure of 1200-2000 psi. Immediately after passing through the high pressure pump, air is introduced into the stream at 1200 to 2000 psi. The sludge and air pass through a series of heat exchangers which raises the temperature of the mixture to 450°F.

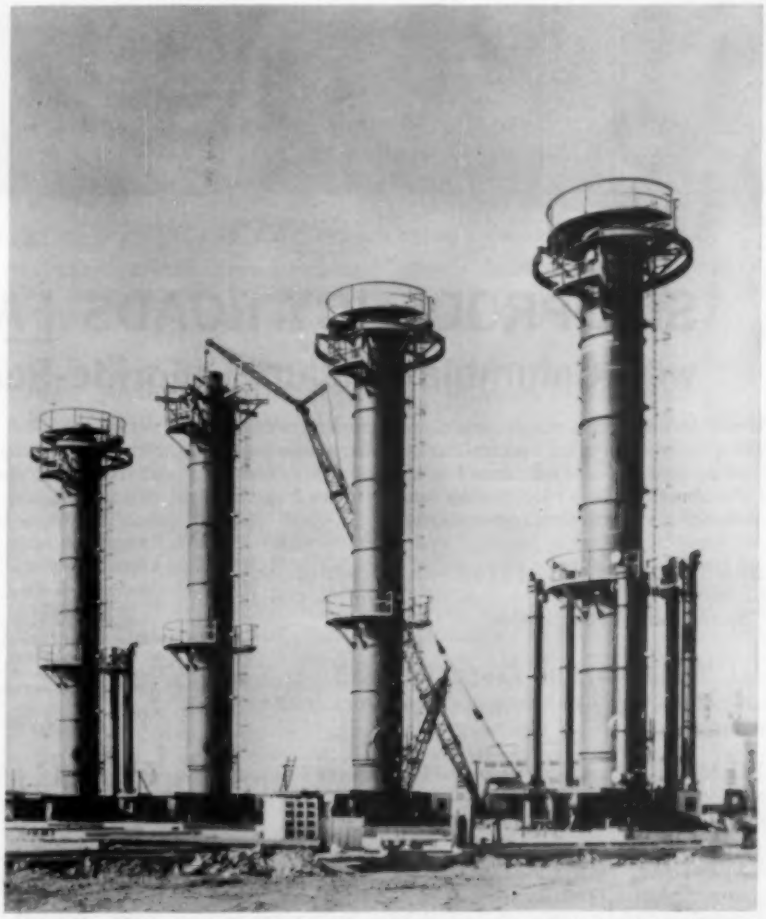
The mixture then enters the bottom of the reactor, moves upward through a coarsely baffled path in the central body of the reactor and spills over a port at the top of the inner shell into a jacket formed by the walls of the inner and outer shells. During the period of flow through the reactor, organic matter undergoes degradation by wet-combustion. The reaction is complete when the mixture spills through the port. The end products—steam, nitrogen, carbon dioxide, water and ash at approximately 515°F.—pass through the bottom of the reactor into the heat exchangers where the sensible heat of the mixture is used to preheat the incoming sludge and air. The temperature of the reactor content is reduced to 150°F. by passing through the heat exchangers and a water cooler. It finally passes through a separator where the gases are vented to the atmosphere and the liquid effluent, containing the ash, is withdrawn continuously from the bottom of the separator.

In later designs, the reactor is built with a single wall and the reactor effluent is removed from the top of the tower.

A statistical analysis of 20 runs of the pilot plant operated at the Metropolitan Sanitary District of Greater Chicago showed that within the range of the volatile solids concentrations studied, COD reductions of 79 percent and volatile solids reductions of 89 percent were achieved. Total solids reductions averaged about 67 percent.

The effluent from the reactor is high in ammonia and volatile acids and has a BOD range of 5400 to 8400 mg/L which represents a reduction of about 60 percent from the BOD of the original liquid sludge. It is discharged from the reactor as a sterile liquid. This effluent will be returned to the sewage flow for treatment before discharge to the river.

The gases discharged from the reactor are nitrogen, carbon dioxide, a small amount of oxygen and a trace of hydrocarbons. They have a slight amine odor. They carry no fly-ash and will cause no air-pollution problems. The ash has a volatile content of 13 to 17 percent, averaging about 15 percent. It settles readily to about 10 percent of the original effluent volume in one hour and it is biologically stable.



● **FOUR reactors and associated heat exchangers are a part of the sludge disposal works for the Chicago West-Southwest plant. Each unit has a capacity of 50 tons/day.**

Photo Courtesy Bureau of Public Roads, Dept. of Commerce

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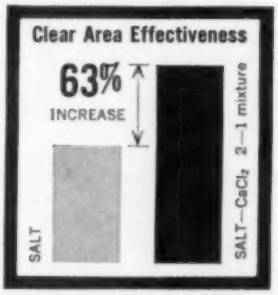

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

$1000 Scholarship Award Available to Engineering Student

Chicago, Ill. — Applications are now being accepted for the 1961 $1,000 Aid-to-Education award administered by the American Public Works Association and sponsored by *The American City* magazine.

The award consists of $1,000 for study in the field of public works engineering and administration at a school selected by the recipient and approved by the American Public Works Association. In addition, the winner of this year's competition will receive an all-expense-paid trip to the 1961 Public Works Congress and Equipment Show to be held in Minneapolis September 24-27. Here, he will have the opportunity to meet with the top public works officials in the country, hear talks on a wide variety of technical subjects, and familiarize himself with the latest developments in equipment and materials.

The award is intended to provide financial assistance to deserving senior students and graduates of accredited engineering schools who wish to continue their education in preparation for careers in the public works field. All candidates must have satisfactorily completed three years of study at an accredited engineering school and must be enrolled at such school or employed by a municipal public works organization or similar public agency.

The recipient of the award will be selected by a special committee of the APWA. The selection will be based on a rating system which takes into account scholastic capacity, personal qualities and the relative excellence of a paper on some subject pertaining to public works. Demonstrated on-the-job ability will be considered in the case of an individual employed by a public works agency.

Application forms will be made available at the engineering departments of major colleges and universities; or write to the American Public Works Association, 1313 East 60th Street, Chicago 13, Ill. All applications must be in prior to June 1, 1961.

An Aid-to-Education Committee will soon be announced, replacing the one that functioned last year. This committee will evaluate the applicants for the Association.

Public Works Officers Form Saskatchewan Chapter

City engineers and public works officials from many Saskatchewan (Canada) cities met in Regina in November to form a provincial chapter of the APWA. Regina's city engineer, Ken Pattison, was elected chapter president; E. J. Cole, city engineer of Saskatoon, vice-president; and J. D. Reid, Regina Manager, Underwood, McLellan & Associates, Ltd., secretary-treasurer. D.A.R. McCannel was appointed honorary president.

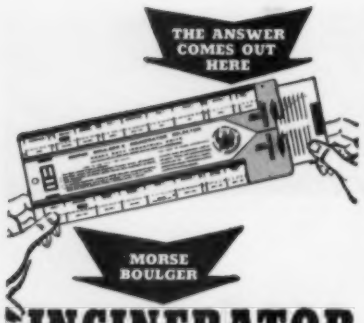
Elected to the executive committee were: M J. Shelley, T. B. Sveinjornson and Jim Wade, city engineers of Moose Jaw, Yorkton and Swift Current, respectively; C. W. Pool of Regina, representing contractors to municipalities; H. W. Carss, Branch Manager, Stanley, Grimble, Roblin, Ltd., Consulting Engineers; and P. L. Downey.

Technical papers presented at the meeting included: "Evaluating Highway-Railway Grade Crossing Treatments" by W McLaughlin, senior traffic engineer, Department of Highways and Transportation, Sask., and "The Saskatchewan River Power and Irrigation Project" by Gordon Watson, chief engineer, P.F.R.A. Frederick Crane, president of the Association and general manager of the Buffalo, N. Y., Sewer Board, attended the inaugural meeting and delivered the dinner address.

Washington State Chapter Meets in Bellingham

One of the most successful meetings in the brief history of the Washington State Chapter was held in Bellingham in November. Program material for the two-day session covered a variety program of public works problems. These included a field trip and discussion of Bellingham's water system and expansion program; the field trip showed the new two-mile diversion tunnel. Other items included a discussion on "Air Sanitation" by Robert Stockman of the Washington State Health Department; "Tech-

OFFICERS: Frederick W. Crane, Buffalo, N. Y., *President;* Albert G. Wyler, New Orleans, La., *Vice President.* REGIONAL DIRECTORS: (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Mosin, Oakland, Calif.; Roy W. Morse, Seattle, Wash.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; Edward J. Booth, Bismarck, N. D.; (term ending 1963) George J. Maher, Lewiston, Maine; Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas. *Immediate Past President,* Jean L. Vincenz, San Diego, California. Robert D. Bugher, *Executive Director.*



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niques in Asphalt Use," a panel discussion moderated by Herb Higgins of the Asphalt Institute; "Coordination and Planning — City, County and State Problems," a panel of discussions by Harold A. Hagestad, Tacoma Coordinating Engineer, Walter Winter, King County Engineer, and Robert Dunn, Urban Engineer of the Washington State Highway Department; "Internal Photographs of Circular Pipes," a discussion and pictures in stereo by Allen Hill of Hill and Ingman, Consulting Engineers; "Traffic Guidance with Reflective Dividers" by Tom Kelly of American-Marietta Company; "Do-It-Yourself Bond Issues" by George Smith, Executive Assistant to City Manager of Tacoma and recently appointed City Manager of Yakima; and "Legislative Procedures and How To Get Legislation Passed" by James R. Ellis, Attorney of Seattle.

The successful program was highlighted by a dinner address given by APWA president F. W. Crane. He termed this convention one of the most successful he had ever attended.

Public Works and Planning Theme of Chicago Chapter Meeting

Chicago, Ill.—Flood control, water supply, air pollution, open space and recreation and local planning statutes were given as examples of areas with which the Northeastern Illinois Metropolitan Planning Commission is concerned, according to Paul Oppermann, executive direc-

The State Official's Place in APWA

The state official who has a hand in public works projects, however small and however remote, can give—and receive—much from the APWA. The association, like the state official, is devoted to the promotion of improved practices in the field of public works. The goals are the same, and the cross-pollination of ideas among all public officers and all others engaged in the production of public works is essential to planned growth.

It is inconceivable that state public works people and local public works officials should not pool their ideas and resources to avoid duplication of efforts. It is similarly inconceivable that state and local officials should not call in experts from time to time to be sure that the best solutions are found to specific problems.

The APWA, through its great membership of all types of persons interested in public works, brings these groups together formally and informally to promote better woking relationships. In such a union there is strength.

There are, of course, many ways in which the APWA can assist in coordinating the various levels—as a clearing-house for new ideas, or adaptations of old ones; as a common meeting ground for opposing views that can and should be judged by competent associates; as a starting-point for discussions and negotiations to decide priorities and assign responsibilities in joint ventures.

The public official—federal, state or local—needs the APWA, and the APWA needs the public official. It is a happy and rewarding association for all.

Ray W. Burgess

Ray W. Burgess, a native of Baton Rouge, is a graduate of Louisiana State University. He is a licensed professional engineer in mechanical and civil engineering. He was employed by Stone and Webster Engineering Corporation from 1942 to 1955 as field engineer, office engineer, resident engineer and assistant superintendent of construction on many projects in Louisiana.

In 1955, he became director of the City-Parish Department of Public Works at Baton Rouge; and in 1960 was appointed Director of the Louisiana Department of Highways. In his work with the City-Parish government, he also served as a member of the City-Parish Planning Commission, the Sanitary Sewer Expediting Committee and the Capital Improvements Expediting Committee.

He is a member of the Louisiana Engineering Society, the ASME, APWA, ARBA, ASCE and NSPE.

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Color movies of the world's finest and fastest rubbish collection unit show the versatility of ROTO-PAC on both typical and unusual routes. Prefer a "live" demonstration? A letter or phone call arranges it. No obligation, of course.

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February 4, 195°

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Fitchburg, Mass.
Mr. Perini, Superintendent

Dear Sir:

On March 23, 1955, we purchased one of your Chippers. You may be interested to know that this machine operated a total of 1,693 hours without a breakdown of any kind. Inasmuch as we are paid for running time only we often start up the chipper 20 or more times daily.

We have followed faithfully your instructions in using a hone on the knives each morning, we find that by doing this we can use the knives for five weeks before sharpening. Even then only about 12 thousands are needed to bring them back.

Contractors find your chipper is ideal and saves them much time and dollars in clearing a woodland area before bull dozing begins.

Your Engineering skill and knowhow has resulted in the finest of all Chippers and I have seen them all in operation.

Hauling time is reduced two-thirds, this results in a large saving in gasoline, parts and labor. I would never again be without one.

Respectfully,

Weldon S. Campbell

Weldon S. Campbell
Tree Warden & Moth Supt.
Greenfield, Mass.

Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs.

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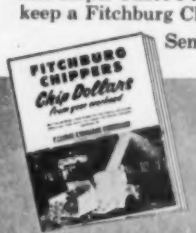

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tor. Oppermann spoke on "Public Works and Metropolitan Planning" at the Chicago Chapter meeting held recently in Chicago.

Metropolitan planning has grown rapidly since World War II and city planning is now well established, but county planning is still very spotty, though increasing. The cooperative approach has proved itself to be a useful one and increasingly effective. Further, he believed that inter-governmental cooperation and joint collaborative efforts will clarify the need for and practical uses of a metropolitan level of comprehensive planning for more orderly and economical area growth and expansion.

The commission, he pointed out, through its Technical Advisory Committee, and in cooperation with the Public Health Service and the Sanitary Water Board has supported a sewage facility inventory in Northwestern Illinois. This work has been completed with over 400 sewage disposal facilities mapped and described. The inventory provides the basic planning information necessary to determine how the area stands in the matter of sewerage facilities. Solution of the complex problem of stream pollution and the capacity for streams to carry waste effluents will call for a high degree of cooperation on the part of all governmental agencies and private industries.

Also, the commission has recently completed a descriptive inventory of the refuse disposal sites of the area; open dumps, sanitary fills, incinerator sites, etc. This is a basic step toward working out a plan and policy with respect to solid waste disposal. The inventory of existing disposal sites has been mapped and information is being tabulated as to site capacities and remaining periods of usefulness. The further work of the Commission in this area will deal with ways and means of reserving desirable locations for future use; a review of state and local statutes as to their effectiveness in dealing with the disposal problem; the development of better information on the volume and composition of refuse so that disposal methods can be related to the materials to be handled; and an analysis of the long range economics of land disposal versus incineration disposal. One of the most important areas that should be stimulated, he said, is research on a better definition of the effectiveness of existing methods and development of new approaches.

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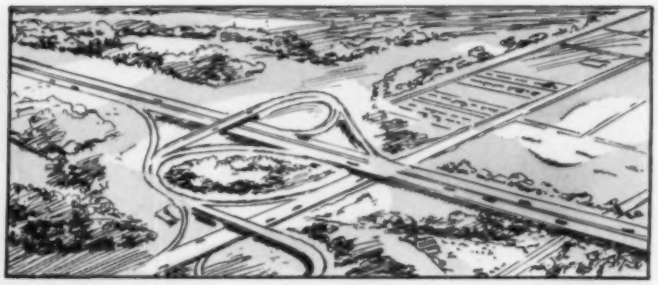


Prepared by **L. G. BYRD,** *Associate Editor*

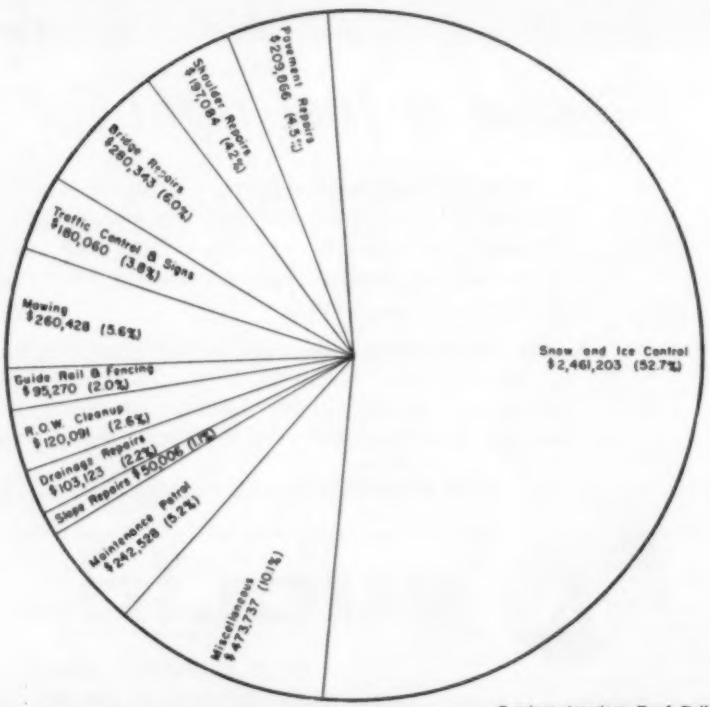
Turnpike Maintenance

Superhighway or turnpike maintenance requires the same basic types of work to be performed on the same component parts as on a typical trunk highway. A significant difference becomes apparent in the two programs when comparing not what but how this maintenance is done. The toll roads have established a high standard of maintenance and set a precedent likely to be followed on the new Interstate System. The New York Thruway in 1959 spent $4,673,739 for roadway maintenance which equalled about $2,000 per lane-mile for the 481 miles of four-lane and 72 miles of six-lane pavement. Because of its Northern location, over half of the Thruway budget is assigned to snow and ice control. During the six months of good weather activities include: Mowing an average of five acres of turf per mile; immediate restoration of low shoulders and damaged guard rail or pavement: regular inspection of bridges and repair of deck surfaces which are particularly vulnerable to deteriorating elements and chemicals; and maintaining, restoring or replacing signs, delineators and pavement markings.

"Turnpike Maintenance." C. H. Lang, Chief Engineer, New York State Thruway Authority. Albany, New York. *American Road Builder*, November, 1960.

Aging and Driving

Today the aging driver is an important factor in traffic and, with the continued growth of this segment of our population, his importance will increase. Chronological age is not the basis for evaluation of driver qualifications—the span of years of capable driving varies widely with the individual. The growth in the number of drivers aged 65 and over is being caused by several factors: The current harvest of the drivers who started in the auto boom of the mid-twenties; the increased proportion of the population becoming drivers; improved health and economic conditions; more leisure time; good roads; road services; and easy to operate, dependable cars. The foregoing factors are accentuated by the greatly increasing number of persons living to old age. Few conclusive studies have been made on traffic accidents by age. 1959 data from the National Safety Council showed that 6.5 percent of the fatal accidents involved drivers 65 and over. These older drivers comprised 6.7 percent of the licensed drivers—which statistics might indicate, on the surface, that older drivers were safer drivers. This erroneous conclusion fails to account for the miles driven by this age group—data on which is extremely limited. Those studies made by Dr. A. R. Lauer, based on a 1948-49 Iowa survey, and by the Bureau of Public Roads, based on 1957-58 field surveys, both showed substantial increases in accident-mile ratios for older drivers. Steps recommended to meet this problem include: Self-help programs for aging drivers; a Senior Citizen Traffic Study and Program to develop factual data and recommendations; and inclusion of aging and driving in the White House Conference on Aging.


Pavement Repairs $209,866 (4.5%)
Shoulder Repairs $197,084 (4.2%)
Bridge Repairs $280,343 (6.0%)
Traffic Control & Signs $180,060 (3.8%)
Mowing $260,428 (5.6%)
Guide Rail & Fencing $95,270 (2.0%)
R.O.W. Cleanup $120,091 (2.6%)
Drainage Repairs $103,123 (2.2%)
Slope Repairs $50,606 (1.1%)
Maintenance Patrol $242,528 (5.2%)
Miscellaneous $473,737 (10.1%)
Snow and Ice Control $2,461,203 (52.7%)

Courtesy American Road Builder

● **DISTRIBUTION of roadway maintenance costs for 1959, New York State Thruway authority. Data include administration, payroll benefits and equipment costs.**

Michigan digs, loads pit-run gravel in less than half the time previously required.

How Great Falls s-t-r-e-t-c-h-e-d maintenance budgets 20%

Faced by the universal problem of rising demands and level budgets, the City of Great Falls, Montana, 18 months ago turned to the mobility of rubber with dramatic results.

After testing all available machines, the City chose a 1¾ yd Model 85A Michigan Tractor Shovel. "It handled better . . . showed more power and digging ability . . . operators had better vision than on comparable units," explains Street Supt William Swingley.

Performance of this power-steered, power-shifted, four-wheel-drive Michigan was so good the City six months later bought a second Model 85A.

Today—counting all costs—the two Michigans are doing *so much more work* city officials can schedule 20% more street, alley and water-main building and rebuilding per dollar of budget.

Save hours of travel time

Michigan 26 mph go-anywhere mobility accounts for some of the increase. Mr. Swingley reports a Michigan often travels to a job, completes it, and is on its way again before crawlers could have been trailer-loaded and hauled one-way.

60% faster loading trucks

Similar advantages have been demonstrated *on* the job. Loading hard-packed pit-run gravel, for instance, a 96 hp Model 85A needs only 2 minutes, often less, to heap a 6 yd truck. Same job with 1-yd crawler-loader used to take 5 minutes.

Save $1,000 yearly repair costs

Output has been equally good on other assignments around this city of 60,000 and its 202 mi of streets, 67 mi of alleys. In winter, Michigans load grader-windrowed snow . . . take about a minute to fill a 6-yd truck. Summertime they feed a hot-mix plant (typical one-machine output: 35 tons of ⅜" and ¾" stone hourly). Units also pick up street sweepings, backfill water trenches. "In the 12 and 18 months we've had the two Michigans," says Supt Swingley, "*We've spent no money at all on repairs!*"

Another of Michigans' many jobs: handling water pipe. This section is 16' long, weighs 2,000 lbs. Machine can lift 9,000 lbs.

8 Models Now Available

12B	16 cu ft	125A	2 yds
55A	1 yd	175A	2¾ yds
75A	1¼ yds	275A	4 yds
85A	1¾ yds	375A	6 yds

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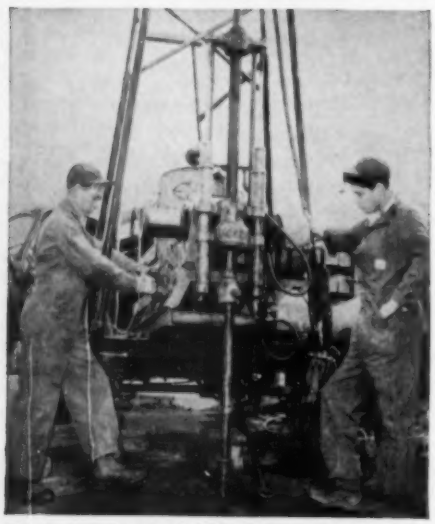

Contractors FROEHLING & ROBERTSON, INC., of Baltimore own the trailer mounted Acker TH Core Drill shown above. It is doing test boring for the new Cumberland Highway.

Wherever highway construction is underway, you will find Acker Equipment engaged in "underground" exploration work.

And, there's good reason!

Acker Rigs are compact, dependable and ruggedly built. Like the Acker TH Core Drill pictured, they can be furnished completely self-contained with water pump, derrick, cargo-type winch, choice of power plant and mounting on trailer, truck or jeep.

For the complete story on why Acker Core Drills are preferred by leading contractors and engineers, please write for Bulletin 30. PW

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Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment.

"Aging and Driving." Burton W. Marsh, Director, Traffic Engineering and Safety Department, American Automobile Association, Washington, D. C. *Traffic Engineering*, November, 1960.

Modern Street Lighting

To date, $106 million has been voted to support Chicago's program of modern street lighting. In planning the new system, Chicago pioneered the use of mercury vapor lighting for residential streets and encouraged manufacturers to produce the 4,000-lumen mercury lamp. In general, the recommendations of the Illuminating Engineering Society and the American Standards Association have been used as a guide to minimum standards. Throughout the progress of the lighting program, lighting levels have been increased beyond the minimums and special attention given to such factors as traffic speeds, roadway conditions and accident statistics. Current use on business and arterial streets provides from 1½ to 2½ foot-candles and ¼ foot-candle on residential streets. Safety benefits from the lighting program are indicated by the decline in accidents from 458 in 1952 to 300 in 1959. Since the start of the program approximately 140,000 new street lights have been put into service. Program completion is anticipated by the end of 1963.

"The Chicago Story." Lloyd M. Johnson, Commissioner, Chicago Department of Streets and Sanitation. Paper presented at Electrical World Second Street and Highway Lighting Conference, Chicago, Illinois, October, 1960.

Geometry of Highway Curves

Much of the calculation involved in the formulation of the alignment of a highway is routine arithmetical work, and it is highly desirable that such work be reduced to a minimum. The representation, in nomographic form, of the formulas connected with the geometric design of a highway removes the necessity for such routine calculation and gives results, which while not generally to the degree of accuracy of those computed from tables are, nevertheless, sufficient for the purpose, particularly in the trial alignment stage. Five examples of such nomograms are given, together with notes on the manipulation of the formulas and the construction of the nomograms, and with suggestions for alternative forms. It is considered that

FOUND!

A winning combination: Asphaltic concrete made with Chevron Asphalt over a Dilute Bitumuls Treated Base.

For "Deep-Strength" Construction PLUS Economy!

Realignment of U. S. Route #99 (Pacific Highway) between Albany and Eugene, Oregon, involves construction of twelve miles of new, heavy-duty pavement.

4 inches Asphaltic Concrete made with Chevron Asphalt; laid in 2 lifts as indicated.

Top 2 inches of crushed stone base treated with diluted Bitumuls; then compacted.

Compacted base stone

The original "specs" called for construction of a compacted stone base, surfaced with 4 inches of asphaltic concrete. As a result of preliminary tests, however, a Field Change Order was issued specifying treatment of the top 2 inches of the base with an economical nine-to-one dilution of Bitumuls.

Dilute Bitumuls Treatment "controlled" the top of the base during surfacing; provided water-resistance that contributed to an overall stronger pavement. Over the base, two lifts of asphaltic concrete made with Chevron Asphalt were placed to complete the construction.

The job is under the direction of the Oregon State Highway Department. The contractor, Warren Northwest, Inc., has done a fine job of coordinating all phases of the job. One key factor in maintaining operations on schedule has been the dependable, on-time service on Bitumuls and Chevron Asphalt deliveries.

Call office nearest for details on how Bitumuls Emulsified Asphalts and Chevron Paving Asphalts can be combined to give you better pavements at lower cost.

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these charts, or variations or extensions of them, could well be drawn out to a large scale for general use in a highway design office. It is not suggested that the use of these charts should supplant the accurate determination, from tables, of the final alignment, once the latter has been established—accurately determined values are obviously required for design purposes and for setting out. It is suggested, however, that at all stages of the investigation up to the detailed calculation of the final alignment, the use of these nomograms will ensure an order of accuracy well within that required and will lead to real economy of effort.

"The Rapid Evaluation of the Geometry of Highway Curves." P. O. Malone, Engineer, Rendel, Palmer & Tritton, Consulting Engineers. *Roads and Road Construction* (London, England), October, 1960.

County-City Cooperation

County government, as a representative of all the people, is in a position to coordinate roadbuilding programs between the county and cities and thereby equalize the sometimes inequitable redistribution of gasoline funds. To obtain the maximum benefit from the tax dollar, highway improvements should be made where the need is the greatest—without regard for political boundary lines. Such an objective program must be preceded by the development of a master plan. Orange County, California, initiated the preparation of an overall master plan in 1954 under the sponsorship of the Associated Chambers of Commerce, an organization representing all chambers of commerce within the county. The plan, completed 18 months later, provided a fully-coordinated basis for county-wide development of highways and streets. The county and all cities within the county were in basic agreement on the plan. Uniform ordinances on setback, access control and geometrics were then developed and a financing program established. The cooperative financing program was then agreed upon by the board of supervisors and the Orange County League of Cities. The program provides for county financial assistance to cities for uniform development of the arterial system, providing that the city has a satisfactory master plan, setback provisions and access limitations. Generally, cities must match county funds and commit funds to an advertised project within the fiscal year that they were allocated.

"County Plan—Coordinated Program Puts Road Funds Where Need Is Greatest." A. S. Koch, Surveyor and Road Commissioner, Orange County, California. *California Highways and Public Works*, September—October, 1960.

Busy Street Resurfacing

Central Parkway in Cincinnati, Ohio, carrying over 40,000 vehicles per day was resurfaced by crews of the city's highway maintenance division. Detailed advance planning was required to provide for preparatory operations, traffic control, work scheduling, paving operations and line painting. Work was scheduled from 6:30 A.M. to 3:00 P.M. seven days a week. A meeting was held between representatives of the traffic engineering, police and highway maintenance divisions to coordinate control measures and a press notice released to inform the public. After completion of base repairs and raising of castings, paving operations were performed on the outbound lanes from 6:30 A.M. to 10:00 A.M. and on the inbound lanes from 10:00 A.M. to 3:00 P.M. Full-

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width sections averaging 10,000 sq. yd. were completed each day at an average cost, including overhead on labor, of $0.56 per sy. yd.

"Cincinnati Resurfaces Its Busiest Street." William C. Wichman, Director of Public Works, Cincinnati, Ohio. *Street Engineering*, November, 1960.

Slip-Form Paving

A recently completed five-mile section of the Harbor Freeway in Metropolitan Los Angeles, California, is one of the first major urban projects to employ the slip-form method of paving. The section consisted of two 48-ft. concrete roadways separated by a 22-ft. median. The outer 24 ft. of each pavement is 9 in. thick; the inner 24 ft. is 8 in. thick. Subgrade consisted of 8 in. of selected material, the top 4 in. of which was cement treated. The completed cement-treated subgrade was profilographed to insure acceptable smoothness in the finished concrete surface since the Rex slip-form paver depends on the subgrade and the 22-ft. tracks on which it runs to obtain a uniform surface. The average profilograph reading on the subgrade showed an accumulative surface variation of 6.5 in. per mile—well within the California Division of Highways specification of 7 in. for the finished pavement surface. In the paving operation, concrete is placed on the grade between the side plates at the front of the paver where it is struck off by a 24-ft. screed. The hydraulically operated screed with 5 ft. of fore and aft travel spreads the concrete evenly across the lane. Ten vibrators operating submerged in the concrete are followed by a tamper bar, the extrusion plate and oscillating rubber belt. The slip-form method of paving proved to be much faster than conventional fixed-form operations. A smaller labor force and reduced equipment spread promise cost savings—particularly when contractors gain experience in this work.

"Smooth Surface from Slip-Form Paving." R. M. Innis, Senior Resident Engineer, District VII, California Division of Highways. *Civil Engineering*, November, 1960.

Proper Tree Planting

To help educate home owners and others responsible for tree planting along city streets, the Pacific Gas and Electric Company has prepared and distributed booklets and established a speakers bureau to instruct interested groups. Samples of model tree control and ordinances for city and county areas have been made available, both types of ordinance having the endorsement of the National Shade Tree Conference. Three simple rules are suggested to a community planning a tree program: 1) *Look down* at soil type, root growth, water requirements and drainage; 2) *look up* at overhead wires, potential storm damage, pruning requirements; and 3) *look around* at space for full grown tree and effect on surroundings. Planning as well as planting is required if streets are to be lined with assets.

"Proper Tree Planting Program Saves Maintenance Headaches." William Siden, Tree Specialist, Pacific Gas and Electric Company. *Western City*, October, 1960.

Other Articles

"Ohio's Blueprint for Bare Roads." Keys to successful **winter maintenance** include planning, equipment preparation, radio communication, good material application and accurate forecasting. By J. W. Reppel, Engineer of

(*Continued on page* 119)

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Original Low Cost VERMEER

POW-R-STUMP CUTTER

Rips Stump To Shreds In Minutes!

You'll save hundreds of back-breaking man-hours and thousands of dollars annually . . . with a Vermeer Pow-R-Stump Cutter. The choice of tree experts everywhere! It's the modern way, the economical way to remove ugly stumps. Mail the coupon for all the details . . . and a FREE demonstration.

Photos show how big revolving cutting wheel rips stump to chips . . . down to 10" below the ground. Dirt is replaced, chips removed and area is ready for seed or sod.

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Surface Drainage Problems Caused By Urban Development

DONALD W. TUCKER
Design Division
Department of Public Works
Baltimore County
Towson, Maryland

An abstract of a paper presented at the 8th Annual National Highway Conference held at Atlanta, Georgia.

THE PROBLEMS of increased surface drainage in new developments may be categorized three ways. First, are those problems within the development itself. Second, are the problems associated with the waters as they pass through old downstream developments. Last, is the effect upon existing roadway culverts and roadway drainage systems.

In the case of the new development, we must find solutions continuously, since the mass exodus of the public from the cities into the surrounding suburbs will continue to create drainage problems. While most municipalities require a lot-grading plan for checking when processing a new development, experience proves that enforcement of accurate grading through inspection is almost impossible. Most developers can be depended upon to grade the individual lots in a manner which approximates the plan. Where owner complaints do arise, the difficulty can usually be resolved in a meeting between the developer, the owner and county officials.

Another problem within the new development is that of roadside drainage. Hand - formed berms, paved-valley gutters and open side ditches have not proven satisfactory. They require too much maintenance or they become a nuisance and an eyesore. Therefore, either concrete curb or machine laid macadam berm should be used to control the roadside water.

Years ago developers could be selective. Since many acres and sites were available and most developments were small, the best pieces of high ground could be and were obtained. If a large tract was developed with a stream coursing through it, the ground immediately adjacent to the stream could be left undeveloped.

Today, the motivating factor for utilization of all ground is the purchase cost and the cost of development. Since these costs are high and such a large percentage of land development cost is fixed, the developer must make the best possible utilization of his land to realize a profit and still sell competitively. In the development cost, a point of diminishing return is reached when it is more profitable to leave a stream open, create a drainage reservoir and lose lots rather than pay for an enclosed system which requires only a narrow easement.

Drainage Policies

To solve the drainage problems, a method must be determined and a procedure established. In Baltimore County, with which I am most familiar, several policies have been tried. Three have been abandoned, either because they were unjust to the developer or because they were working a financial hardship on the County. Currently, our policy is one in which expenditure experience for each type of development is analyzed and from this a storm drain unit cost is derived for each type of house. This average cost then will support the cost of drainage work attendant with the development. If an incremental increase is then added to this basic cost, surpluses can be created and these surpluses can be applied to downstream improvements. For the row house development, which has a high runoff factor, the cost is highest, at $7.50 per front foot, with a maximum of $250 per lot; for the cottage type development the cost is $6 per front foot, with a maximum of $350 per lot. The developer of commercial and industrial property is required to pay for the full cost of improvements. Under this system the County collects a lump sum from the developer based on the number of lots. Out of this assessment, the County pays for the actual cost of storm drain construction, including all off-site drainage costs (provided that the total cost does not exceed two-thirds of the road cost, and that none of the structures is larger than 48 inches in size). All costs in excess of two-thirds of the road cost, and the cost of any structure in excess of 48 inches in size, is to be paid by the developer.

This policy has been in effect for over four years and Baltimore County has found it most satisfactory. Experience has demonstrated that using the 48-inch size of drain as an upper limit for participation proves equitable. For streams requiring a larger pipe, the developer may establish an open drainage reservation or, if he feels it economically feasible, he may construct the larger drain, at his cost, and reclaim additional lots. The incentive for the municipality to limit its participation lies in the fact that this scheme prevents the developer from acquiring a swamp or major drainage course and have the County enclose the stream, thereby creating lots for him.

As previously mentioned, the developer of property in Baltimore County does have the right to establish a drainage reservation. By County standards, the reservation must be at least 50 feet wide and contain a 50-year design storm. The side slopes can be no steeper than five to one and the reservation must be deeded, in fee simple, to the County. The owners of adjacent lots are therefore not saddled by taxation for land which is not completely usable. However, with such flat slopes, most owners do not mind mowing the additional lawn, thereby eliminating County maintenance on this property. In addition, this makes it possible for them to utilize the area most of the time. This practice has been found to be particularly sound and obviously this type of reservation is better in appearance than the usual deep, unsightly ditch.

Under this same policy, the developer is not in all cases, required to reshape the channel completely. If the existing stream is sufficiently straight, and the cross section large enough to accommodate flows, then the stream may be left in place. The fee simple reservation must still be donated to the County; and, if warranted, anti-scour and anti-erosion devices must be constructed so that the stream does not meander out of its reservation. This approach to the

instances, and has proven successful whenever the adjacent terrain and proposed land use lend themselves to this method of treatment.

Downstream Problems

Moving downstream from the new developments, we are faced with the major problem of the storm water as it passes through older downstream communities. When dealing with the drainage problems in the new development, the municipality is relatively free in its choice of how to solve the problem. This is not the case in the older developments since the engineer is limited by existing structures, by financing and by the public who have lived there for many years.

When these older developments were constructed, no thought was usually given to the stream or creek running through the property. Later the picture radically changes. The stream may carry sewage and may often crest its banks, flooding structures and eroding usable ground.

What is the role of the local government in this problem? Principally, it is dependent upon the feeling of the administration, the amount of local pressure applied and the financial position of the municipality. Various overtures may be made to rectify problems in certain spot locations, as an appeasement. But the primary issue remains unsolved, and that is: Does the local government have any obligation to the people in this case?

Thus it seems the only solution is tied to the collection of storm drain, front-foot assessment or area charges in new developments. By collection of these charges, whether in a lump sum basis per lot, or on a front-footage basis, funds are supplied, or practically supplied, by persons creating the problem. If these funds are insufficient, then they may have to be supplemented by bond issues for capital improvement work.

Another problem within old developments concerns itself with the tie-in of a new drainage system into an undersize older system. In many cases, when the old system was designed, the upstream runoff was not properly calculated. This was not necessarily an error on the designer's part since it is anyone's guess how an upstream area will finally develop. Once again, funds collected from lot assessment can be used for supplementation or replacement of the downstream system.

A third problem within the old development is the problem of the deteriorated storm drain system. Many times these old structures are adequate in size but portions have partially collapsed or are in need of such extensive maintenance that complete replacement is cheaper in the final analysis. Funding of such improvements should be accomplished either from general funds or through capital improvement bonds.

Culvert Problems

Finally, we come to the problem of existing under-road culverts which have become inadequate in size due to the increased runoff from upstream development. Once an insight is gained as to the proposed land-use, the downstream culverts should be checked for adequacy and condition. The condition part of the survey can be kept up to date by maintenance personnel reporting at specific intervals. From this information, a master program of replacement and supplementation can be phased to conform to the limitations of the capital improvement program. In the rehabilitation programs, new materials and methods should not be overlooked. Old box culverts may be replaced by multiple pipes; adequate structures may be made serviceable by using masonry resurfacing or placing a metal arch under the present opening.

It can be seen that, in the urbanizing county, drainage is probably the most menacing problem. For years the tendency has been to overlook drainage problems and to minimize their effect. This shou'd not and cannot be the case. People may tolerate inadequate roads, they may even tolerate inadequate water supply since this usually represents only a seasonal inconvenience. But, in the case of storm drainage, the scene may change from complete tranquility to a complete holocaust in a matter of minutes.

Prior planning cannot be stressed too emphatically. By adopting sound policies which conform to the local financial and legal structure, many later problems may be averted. By adopting a program of public information and education, many of the prospective new home owners may be helped and part of the burden of the County officials lessened. All of these items must be coupled with a progressive financial and development program.

• • •

Water Supplies in Minnesota

Of the nearly 600 communities in Minnesota which have public water supplies only 36 obtain their water from surface sources, although a few others are planning to use surface water because of a lack of sufficient ground water to meet needs.

THE HIGHWAY AND AIRPORT DIGEST

(*Continued from page 117*)

Maintenance, Ohio Department of Highways, Columbus, Ohio. PUBLIC WORKS, December, 1960.

"Municipality Tests Two **Slurry Seal** Methods." Emulsified asphalt and a coal tar pitch emulsion were used in separate slurry seal applications in Princeton, New Jersey, to evaluate materials and application procedures on heavily-traveled municipal streets. PUBLIC WORKS, December, 1960.

"Shrubs for That Natural Look." Experimental **planting of shrubs**, directly from seed, along Connecticut highway, shows promise. By Bernhard A. Roth, Head, Field Information Unit, U. S. Soil Conservation Service, Upper Darby, Pa. PUBLIC WORKS, December, 1960.

"Repair of a Disintegrated Bridge Deck." **Latex mortar** used to apply one-half-inch thick resurfacing to Maine highway structure. By Andrew Adams, Research Engineer, Maine State Highway Commission, Augusta, Maine. PUBLIC WORKS, December, 1960.

"Aggregate Storage." Texas highway foreman constructs effective aggregate storage bins using creosoted timbers and I-beams salvaged from old bridge. By Herbert Snyder, Senior Maintenance Foreman, Texas Highway Department. Texas Highways, October, 1960.

"Turnpike Rejuvenation Underway." **Bituminous resurfacing** and shoulder stabilization program underway on older sections of Pennsylvania Turnpike. Constructioneer, October 31, 1960.

"Treated Subgrade." Smoothness and uniformity obtained through cement treatment of subgrade to permit good **slip-form paving**. By James L. Needham, Senior Resident Engineer, California Division of Highways. California Highways and Public Works, September-October, 1960.

"Prestressed Concrete Airport Apron." A 132-ft. by 150-ft. apron cast in alternate strips 15-ft. and 7½-ft. wide was prestressed with 1⅛-in. Macalloy bars at Gatwick Airport in Surrey, England. Contractors Record and Municipal Engineering, October 26, 1960.

"Design of **Signal System** by Graphical Solutions." By B. M. Davidson, Assistant Dean and Associate Professor, Civil Engineering, University of Wisconsin. Traffic Engineering, November, 1960.

"Getting **Accurate Grading.**" Tests conducted to compare motor grader using automatic blade control and using manual control indicated potential increases in accuracy and productivity with automatic controls. By R. L. Peurifoy, Construction Engineer, Bryan, Texas. Rural Roads, November, 1960.

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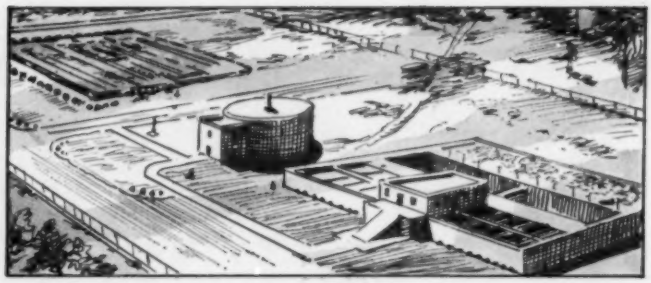
THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Baltimore's $68-Million Plans

Annually for the past decade the City of Baltimore, Md., has invested approximately $3,870,000 to gear its sewage works to the needs of the city proper and the adjacent metropolitan areas in Baltimore and Anne Arundel Counties. At present the City operates and maintains by funds from a general tax levy three treatment plants, 10 sewage pumping stations, two drainage pumping stations and a separate system of sewers. New developments planned for the next decade include: Major improvements at the Back River and Patapsco Sewage Treatment Works; construction of two new pumping stations; and increasing the capacity of three of the existing pumping stations. Numerous force mains, interceptors and relief sewers will be necessary. The estimated cost of these improvements is $67,500,000. Each of the projects and facilities are described in detail in the report.

"No 'Crash' Timetable Involved in Baltimore's $68-Million Plan." By C. E. Keefer, Sewerage Engineer, Bureau of Sewers, Baltimore, Md. *Wastes Engineering*, November, 1960.

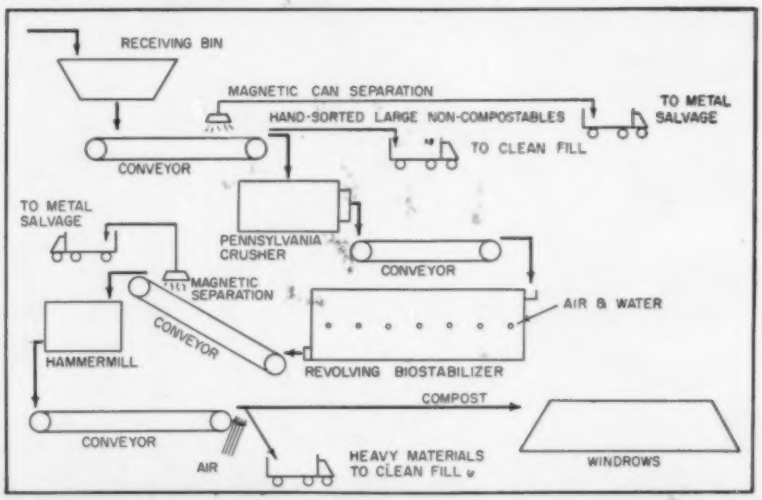
Surfactants and Treatment

For a period of two and a half years chemical analyses were made on the content of anionic surface-active agents (ASAA) in raw sewage and in the waste under treatment at points throughout the pilot waste treatment plant. The wastes under study were primarily domestic, with some admixture of wastes from light industry, restaurants, retail stores, etc. The effect of normal levels of ASAA on primary settling, activated sludge, and trickling filter treatment in a 50-gpm pilot plant was studied, as was the ability of the various treatment units to remove ASAA. The experimental data suggest the following conclusions: (1) The mean value of ASAA concentration in raw sewage was 6.4 mg/l individual daily values varying from 0.5 to 11.4 mg/l. (2) The mean removal of ASAA as the sewage passed through the plant was 33.8 percent when the aeration tank was the only biological unit in operation. The removal increased to 37.8 percent when the trickling filter and aeration tank were operating in series. (3) The mean removal of ASAA during primary settling was 0.3 percent. (4) ASAA in the concentration levels present in raw sewage did not interfere with settling in the primary tank. (5) The mean removal of ASAA in the aeration tank was 30.2 percent based on tank influent concentration. (6) The mean removal of ASAA by the trickling filter was 18.8 percent based on filter influent concentration. (7) The average composition of ASAA in the raw sewage was 69.8 percent sulfonate ASAA and 30.2 percent sulfate ASAA. (8) Of the ASAA removed by the aeration tank, 76.9 percent was sulfonate ASAA.

"Effects of Anionic Surface Active Agents on Waste-Water Treatment Units." By George W. Malaney, Waldron D. Sheets, and Judy Ayres. Respectively, Asst. Professor of Bacteriology, Research Professor and Technical Assistant, Water Resources Center, The Ohio State University, Columbus, Ohio. *Journal WPCF*, November, 1960.

Norman, Okla. Composting Plant

The development of the refuse composting plant which was installed and placed in operation in Norman, Oklahoma, in March, 1959, was based on the concept that composting is a straightforward biochemical process susceptible to engineering analysis and to control by practical materials-handling methods. Furthermore, the developers believed that the process should be carried



● **SCHEMATIC flow sheet for a Dano composting plant. At Sacramento, a unit has been in operation for four years processing sludge, manure, grass, cannery wastes.**

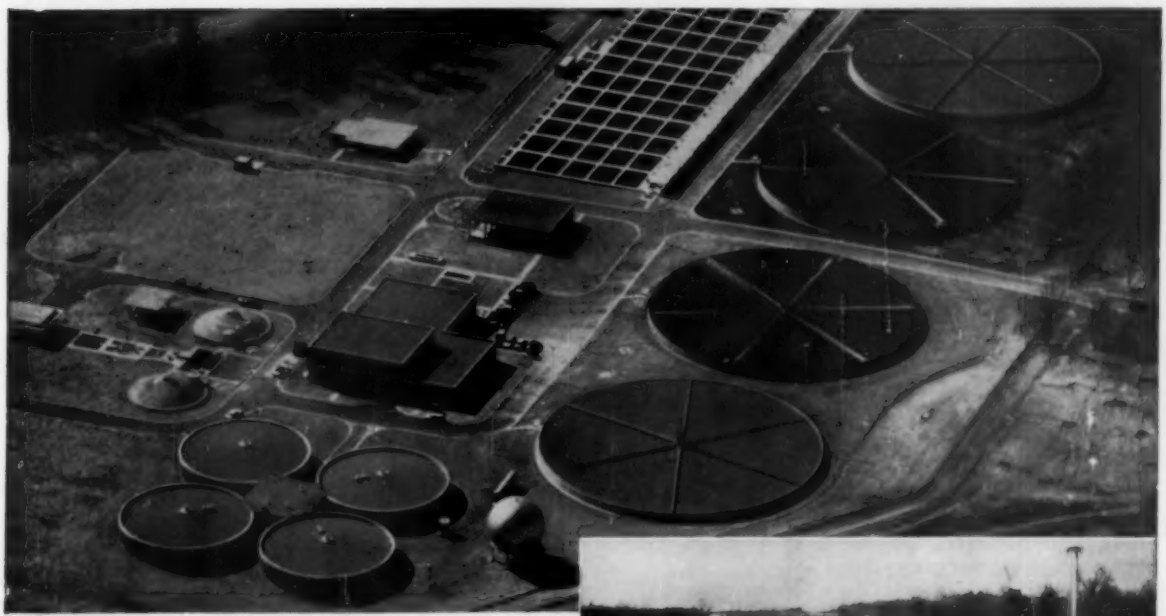
Winston-Salem is Big Business

When a city jumps from 13,600 to 93,000 in population in less than four decades—you have "bigness" in growth. When that same city becomes a leading industrial center and has an industrial waste almost equivalent to its expanded population—you have "bigness" all over again. Winston-Salem is that city!

The four giant P.F.T. Rotary Distributors, 200′ in diameter, are characteristic of this tremendous growth. Equipped with specially designed P.F.T. Spreader Jets, for uniform distribution, these soundly engineered and ruggedly constructed distributors handle a flow of 25.0 mgd!

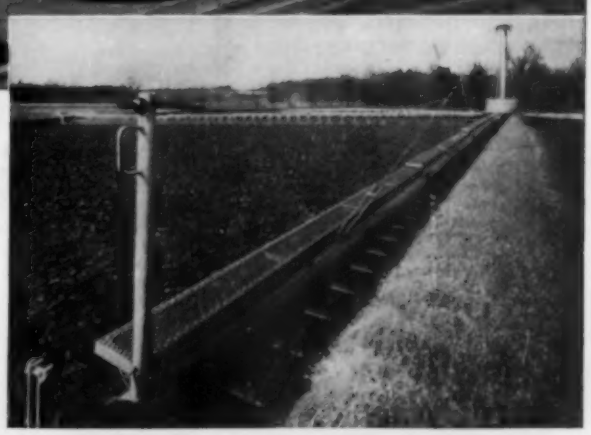
Other P.F.T. equipment in this modern sewage treatment plant, capable of handling a population equivalent of 200,000 and designed by Piatt and Davis of Durham, N.C., includes: Four 90′ Floating Covers, three complete Pearth Gas Recirculation Systems (the fourth digester is arranged for future Pearth which can be installed without interrupting digester operation), three P.F.T. #750 Heaters and Heat Exchangers that are gas and oil fired, Gas Safety Equipment, Supernatant Equipment and Floating Cover Gauge Boards with High and Low Level Alarms.

Crack engineering and construction teams, along with high quality P.F.T. sewage treatment equipment, gives progressive Winston-Salem truly a plant to be proud of.



(*Above*) This is Winston-Salem's Sewage Treatment Plant. Engineering skill and modern treatment equipment makes this plant one of the finest in the country.

(*Right*) 3 tons of bronze forgings are incorporated in the four P.F.T. Rotary Distributors at Winston-Salem. The P.F.T. Spreader Jets are two-piece forged bronze units with removable deflectors.



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out in a clean, attractive, mechanized installation into which unsegregated municipal refuse is dumped at one end to emerge as compost at the other. Special efforts were directed to the development of equipment to overcome the lack of grinders and other materials-handling equipment especially suitable for working with municipal refuse. The four major phases involved in the refuse handling are: (1) Receiving, sorting and salvage; (2) grinding and mixing; (3) composting; and (4) screening, bagging and storage. The entire operation from the receiving of new refuse to bagging of finished compost takes place within a single steel structure. Refuse discharged from the collection vehicles into the receiving hopper is deposited on a broad belt where it is handpicked for salvable items such as rags, metals, salable glass and corrugated cardboard. Ferrous metal is removed by means of a magnetic separator. Large uncompostable materials are also removed from the moving belt. The refuse is then carried through two successive grinding operations. The first type, called a Pulverator, consists of a large diameter steel cylinder set at a slight inclination from the horizontal, which revolves very slowly on its horizontal axis. The refuse fed in at the higher end is pulverized and thoroughly mixed by means of rows of heavy bar hammers which fall by gravity as the cylinder rotates. The second type of grinder is a horizontal hammer mill with a studded shell and a central core cylinder to which is anchored a series of steel chains carrying heavy swing hammers. Both of these two types of grinding equipment have proved to be inexpensive to construct and long-lived under constant use. After the material passes through the primary grinding operation, it is elevated by a bucket conveyor to the topmost of three composter cells tiered one above the other. The freshly ground refuse moves slowly from one cell to the next and is discharged into a secondary grinder. The entire process from primary to secondary grinding requires three days. From the secondary grinder the partially composted refuse is again elevated by bucket conveyor to a second set of three tiered composter cells which provide an additional three days of composting. Then the composted material is screened, bagged and stored for sale.

"Refuse Composting Plant at Norman, Oklahoma." By Dr. P. H. McGauhey, Director, Sanitary Engineering Research Laboratory, University of California, Berkeley, Calif. *Compost Science*, Autumn, 1960.

Bulk Waste Incineration

Some of the bulky wastes which are not normally consumed in conventional municipal incinerators are the following: (1) Demolition lumber, roofing and tar paper; (2) industrial wastes, cartons and crates; (3) tree stumps, trunks and branches; (4) furniture and mattresses; (5) refrigerators, stoves, washing machines and appliances; (6) scrapped automobile bodies. A questionnaire survey of 24 communities of over 400,000 population indicates the following practices in the disposal of large items of refuse: (1) The open burning of demolition lumber on building sites and dumps is still practiced in many large cities. In a few communities shredders are used to reduce some of the bulky combustible material to sizes that can be fed mechanically to municipal incinerators. However, the oversized combustibles are usually hauled to landfill operations. (2) Tree trunks and stumps are sometimes burned at dumps but are

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Only a third of the Jeffrey flocculation-settling system is visible in this construction photograph.

Taken two years ago, this airview shows the wide extent of this 122 mgd treatment plant. Consulting Engineers, Haven & Emerson of Cleveland and New York.

Flocculation and settling are handled here in the same tanks, training baffles being used to separate the two functions. Eight of these combination tanks provide detention in the flocculation zone for 30 minutes and in the settling zone for 90 minutes, or a total of 120 minutes of settling time without flocculation, based on a daily flow of 122 mgd.

Jeffrey sludge collectors are in each channel of the flocculation tanks, as well as in each channel of the settling tanks.

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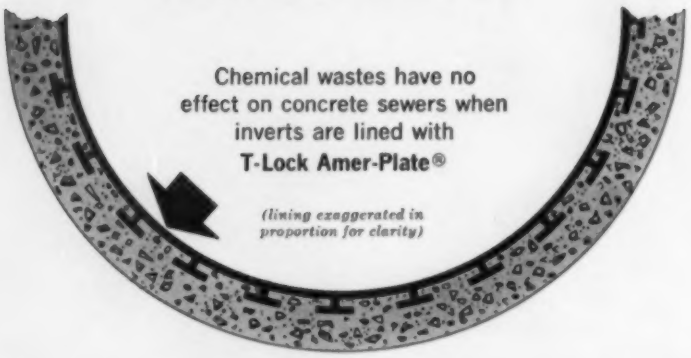
usually buried in sanitary landfills. (3) Open burning at dumps and sanitary landfilling without burning are the general methods of disposal of mattresses, old furniture, crates and other large combustibles. (4) Bulky metallic refuse not salvaged by junkers is usually buried in sanitary landfills. (5) Open burning is a recognized source of air pollution, but is practiced as an economy measure in extending the life of disposal areas, and for saving haulage costs by burning waste lumber at demolition areas. Conical steel refuse burners have been demonstrated for burning bulky wastes and are a marked improvement over open burning. Smokeless burning of automobile bodies for the salvage of steel has been demonstrated by large conveyor-fed furnaces which either have after-burners or electrostatic smoke precipitators. A smokeless, economical firebrick auto-body burner for capacities up to 30 bodies in 8 hours is under development.

"Auto Body and Bulk Waste Incineration." By E. R. Kaiser and J. Tolciss. Respectively, Senior Research Assistant and Associate Research Scientist, College of Engineering, New York University, New York 53, N. Y. *Research Removal Journal*, November, 1960.

How to Protect Concrete Sewers from Chemical Wastes



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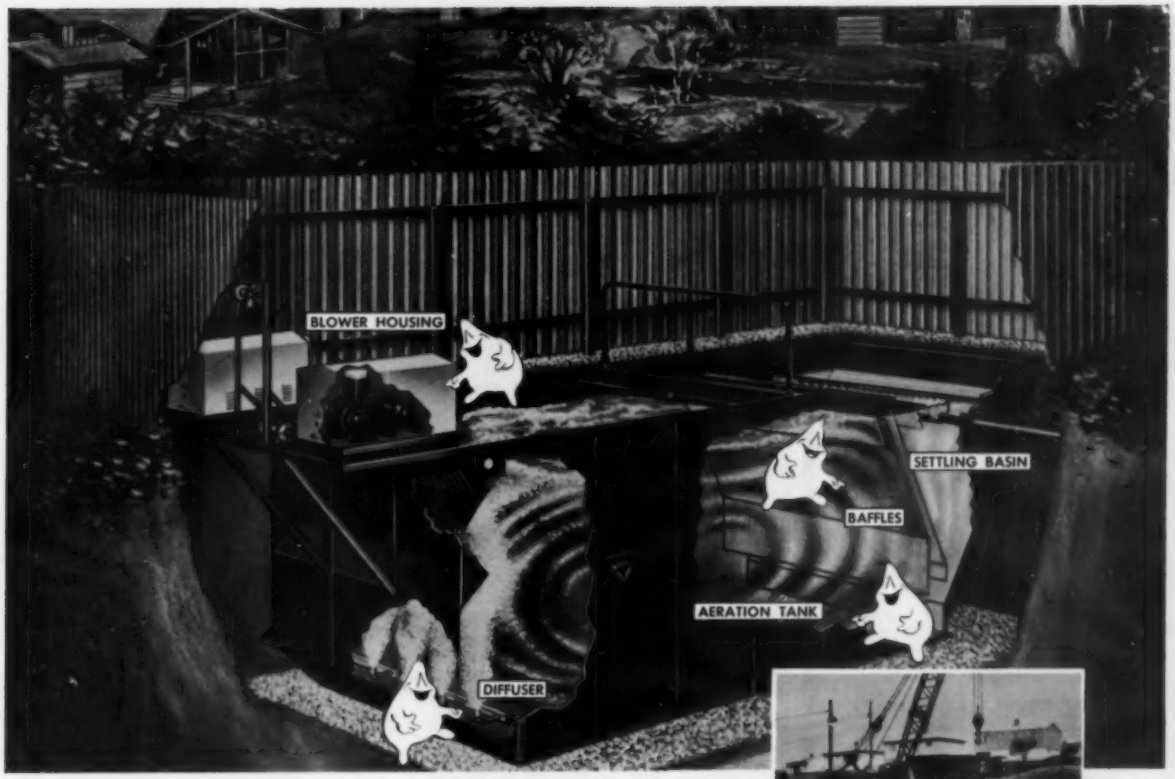
Unique Small Treatment Plant

The Coast Manufacturing and Supply Co. near Livermore, Calif. was faced with the problem of providing domestic sewage treatment at its plant and for a colony of 15 employee homes, with about 65 to 70 people, while meeting unusually high effluent standards with a minimum amount of daily attention from an operating standpoint. The plant which was designed and installed about a year ago consists in a unique combination of equipment: An aerobic digestion plant followed by a diatomaceous earth filter for effluent polishing. The unusually high effluent standards established by the water pollution control agencies required that the domestic sewage, which runs about 200 mg/1 BOD and 400 mg/1 suspended solids, be reduced to an effluent with less than 10 mg/1 BOD, 10 mg/1 suspended solids and 5 mg/1 grease. A Yeomans Cavitator aerobic digestion system was employed as the basic treatment device. As the multiblade rotor revolves, air is drawn down the hollow shaft and is discharged into the liquid effecting complete mixing and aeration of the sewage. Although diatomite water filters had not been used previously in full scale sewage treatment, it was decided that this type of filter would be adaptable for polishing the effluent. The new diatomite water filter developed by De Laval Turbine Pacific Co. was selected for its many automatic features. This includes automatic precoating of the filters, continuous addition of diatomaceous earth at a controlled rate during the filtering process, backwashing and placing the filter back on the line again. The plant requires about 30 minutes of manual attention per day. The equipment and construction costs of the Livermore plant was approximately $25,000.

"Aerobic Digestion + Diatomite Filter." By Harry Shatto, PUBLIC WORKS, December, 1960.

Other Articles

"Dewatering Rates for Digested **Sludge in Lagoons.**" Factors investigated in this study were the effects of depth of sludge layers on the ultimate dewatering rates by drainage, and the effects of transpiration on drying rates. By Edgar A. Jeffrey. Asst. Professor of San. Eng., University of Missouri, Columbia, Mo. Journal WPCF, November, 1960.



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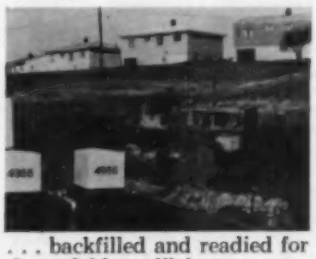

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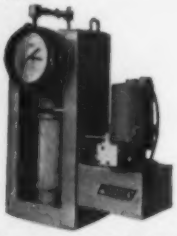

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Determination of the Flow Parameters of **Sludge.**" A research report describing how a capillary viscometer may be used for these measurements. By John M. Sirman, Senior Student, Civil Engineering School, University of Delaware, Newark, Del. Water & Sewage Works, November, 1960.

"**Hypochlorination** of Wastes." This is the third in a series of four parts dealing with hypochlorite-chlorine materials and their use in environmental sanitation control. By Edmund J. Laubusch, Technical Manager, The Chlorine Institute, Inc., New York, N. Y. Water & Sewage Works, November, 1960.

"How to Make **Joint Sewage and Industry** Wastes Systems Work." The planning and cooperative engineering efforts exemplified by this project are typical of the increasing interdependence of industrial and municipal wastes treatment problems and the results which can be achieved through cooperation and joint action. By Ernest W. Whitlock and Thomas P. Quirk, Partners, Malcolm Pirnie Engineers. Wastes Engineering, November, 1960.

"**Fine Grind Not Wanted.**" New process for granulating sewage sludge for fertilizer reduces objectionable fines, gives more salable product. By C. E. Keefer, Sewerage Engineer, Bureau of Sewers, Baltimore, Maryland. PUBLIC WORKS, December, 1960.

"**Stream Pollution.**"—"A Reappraisal of Deoxygenation Rates of Raw Sewage, Effluents and Receiving Waters." Results of a 35-year period of investigation of the Mississippi River and its principal tributaries. By George J. Schroepfer, Maurice L. Robins, and Russell H. Susag, Respectively, Prof. of San. Eng'g., University of Minnesota; Chief Chemist and San. Eng., Minneapolis—Saint Paul Sanitary District; and Research Fellow in San. Eng'g., University of Minnesota, Minneapolis, Minn. Journal WPCF, November, 1960.

"**Composting Refuse** at Sacramento, California." A detailed report on the Dano plant at Sacramento, which has been in full-scale operation since 1956. By Clarence G. Golueke, Sanitary Engineering Research Laboratory, University of California, Berkeley, California. Compost Science, Autumn, 1960.

"How Cities Distribute **Sludge** as A Soil Conditioner." This report describes the experiences of cities which have been marketing and distributing sludge for soil conditioning purposes and also offers suggestion to improve distribution of these organic wastes. By Jerome Olds, Editor, Compost Science, Autumn, 1960.

"Method for **Determining Completion of Composting.**" Research at the University of California offers a simple procedure to determine the end of the composting period based on pH changes which take place in organic material. By G. J. Jann, D. H. Howard and A. J. Salle, Department of Bacteriology, University of California, Los Angeles, California. Compost Science, Autumn, 1960.

Population and Land Areas of Resort Hotels

In planning resort areas, the number of hotel guest rooms or units to be provided per acre of site available is important. Harland Bartholomew & Associates office in Honolulu sent questionnaires to a selected list of 141 resort hotels on the United States mainland and the Caribbean area to learn the density characteristics. The following information was sent up by Donald H. Wolbrink, a partner in the firm.

The area problem arises in large part from the increasing land prices which may affect the density of hotel development. While hotel owners must make a profit on their investments, visitors demand some open space and a retention of those qualities or native characteristics which set one particular resort area apart from others. To the architect and engineer the question is: What are the characteristics of the site plan of a resort hotel which make that hotel an attractive and desirable place to stay? One factor is the density of development or the number of guest units per acre.

The questionnaire was returned by 81 hotels, or 57 percent, but sufficient data was obtained from other sources to include a total of 101 hotels in the report. However, no attempt was made to cover all resort hotels. Most of those included in the questionnaire list were in the average or above-average rate bracket; many could be classed as luxury hotels.

For classification in regard to density, the hotels were placed in three groups—seaside hotels with beach frontage; seaside hotels without beach frontage; and interior hotels at mountains, desert or lake resorts.

The average guest unit density per acre for all seaside hotels, based on 59 returns, was 19.5, with a median of 10.7. The seaside hotels with beaches, 44 replies, showed an average of 21.7 guest units per acre, and without beaches, 12.9. The medians were 13 and 8.7. Interior hotels, 42 replies, showed an average of 15.2 guest units per acre and a median of 10.5. For all 101 hotels, the average was 17.7 and the median was 10.

In the Bahamas, 8 hotels showed an average of 12.9 guest units per acre; 6 hotels in Bermuda had an average of 11; 6 in Puerto Rico averaged 28.9, and 6 in the Virgin Islands 1.7. In all cases the median was below the average.

In the U. S. mainland and Canada, 44 hotels averaged 10.6 guest units per acre; 9 hotels in Arizona averaged 7.3; 16 in California averaged 8.4; and 14 in Florida 39.5. At Miami Beach, 7 hotels averaged 55.2 guest units per acre.

Another method of rating is based on the number of hotels in each density category. Only 5 hotels averaged less than 1 guest unit per acre; 29 were between one and five; 21 were from 6 to 10; 17 were from 11 to 20; 12 were from 21 to 30; seven were from 31 to 4; six were from 41 to 60 and four from 61 to 90.

Density of guest units per acre increased with the size of the hotel. Those with less than 100 rooms averaged 5.7 per acre; in the 100 to 300-room range, the average was 16.1; those over 300 rooms averaged 33.5

Information was also asked regarding swimming pools and golf courses. Of all hotels, 88 percent have one or more pools; 17 percent have two pools; and 7 percent have 3 or more pools. Golf courses were on the grounds by 55 percent and nearby by 58 percent. "Nearby" was based on 5 minutes travel time.

• • •

Robot Monitors on the Delaware

Continuous monitoring of the Delaware River for dissolved oxygen and specific conductance was commenced in November. The $42,000 program financed jointly by the City of Philadelphia and the USGS is expected to detect unusual changes in river water quality caused by industrial chemical spills and rapid increases in turbidity. In addition, it will permit accumulation of records for long range planning of uses of the River. Instruments for sampling, analyzing and recording have been installed at the Torresdale plant, Municipal Pier 11 North, Marcus Hook and Trenton. The instrumentation at Trenton also measures turbidity and pH. In the future the city plans to acquire a portable transistorized analyzer with a 50-ft. sampling cable for measuring dissolved oxygen at various points in mid-stream from a boat. These monitors might eventually be linked with the Water Department's new load center, for relaying microwave signals to the Torresdale plant. Effective use of the data collected by the monitoring stations will probably require computer analysis. This prospect is now under study by the Water Department.

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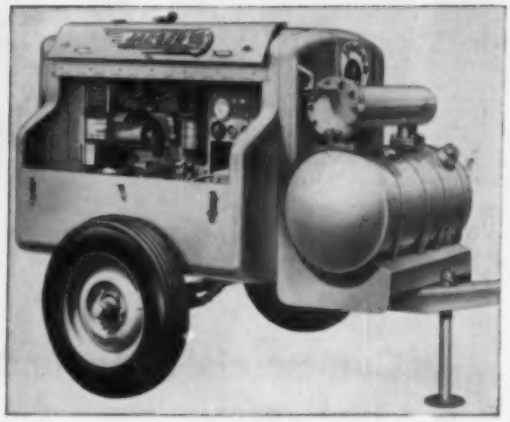

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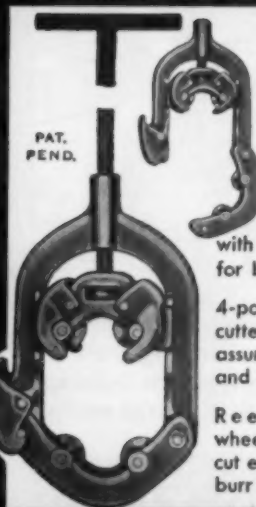

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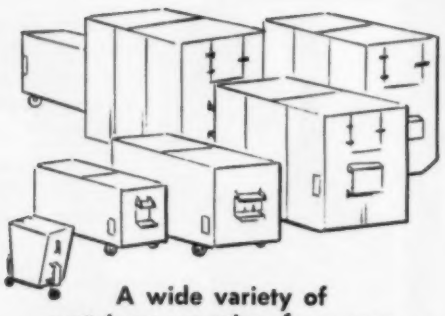

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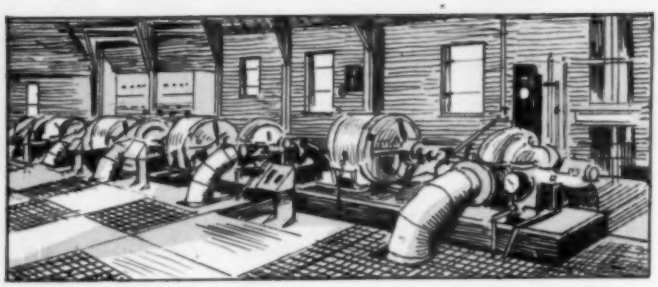
THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Pesticides in Water Supplies

The introduction of DDT and 2,4-D during and after World War II marked the beginning of the chemical pesticide industry which has had far-reaching effects on public health and agriculture. Several hundred pesticide chemicals are now in use and the number of products and formulations registered under the federal Insecticide, Fungicide, and Rodenticide Act exceeds 90,000. Water utilities have expressed concern about the water quality problems that may be caused by the increased use of these chemicals as it is virtually certain that any chemical in widespread use will get into streams in some concentrations. Some of these chemicals are quite toxic to humans and also quite resistant to biologic attack and persist in water sources for extended periods of time. Water utilities, themselves, are substantial users of pesticide chemicals in controlling algae, insects and vegetation in and around reservoirs. Comparatively little is known about the concentrations of pesticide chemicals now in water but DDT has been found in concentrations of 1-20 ppb in a number of large rivers in the U. S. Aldrin, another chlorinated-hydrocarbon insecticide, has been found in the Snake River in a concentration of 1 ppb. These concentrations caused no perceptible damage. A number of fish kills have resulted in the U. S. and Canada from the use of DDT, toxaphene, dieldrin, and endrin which are extremely toxic to fish and other aquatic life. Although many of the pesticide chemicals are not particularly toxic to man, others are among the most toxic materials in common use. This has led to strict regulation of pesticides and to widespread and intensive toxicologic studies of the materials. The U. S. Food and Drug Administration establishes tolerance limits for pesticide residues in or on food products. No official limits have yet been placed on concentrations of pesticides in water in the United States, except for limits on arsenic, selenium, fluoride and lead. In the USPHS Drinking Water Standards, now being revised, consideration is being given to the inclusion of limits on some of the chlorinated - hydrocarbon insecticides and some of the organophosphate insecticides. Research is being undertaken to find answers to some of the problems but little or nothing is being done on several important aspects of the problems regarding pesticides and water quality.

"Significance of Pesticides in Water Supplies." By Richard L. Woodward, Chief of Eng., Water Supply & Pollution Control Research, Robert A. Taft San. Eng. Center, USPHS, Cincinnati, Ohio. *Journal AWWA*, November, 1960.

Recharge at Walla Walla

Because of the progressive decline in water level in some wells taking water from artesian zones of the Columbia River basalt of the Walla Walla Basin, it became apparent that it would be necessary to either limit the total annual pumpage of water from the basalt aquifers of implement a program whereby the safe sustained yield could be materially increased. A program was

Rural Water System Tower

A WATER tower of unique reinforced concrete design was recently completed near Leur, Holland. The reservoir portion is divided into quadrants, connected in pairs so that only half the tank need be out of service for repairs. It is faced with aluminum for insulation and appearance. The shaft which has an inside diameter of 13.6 ft. contains a staircase and inlet, outlet, roof drain and overflow piping. It was constructed with leap-frogging framework and is sectionalized like bamboo with a diaphragm at each joint for strength. It is 132 ft. high and holds 210,000 gallons. The tower was named in honor of Professor W. F. J. M. Krul who is largely responsible for the development of the rural water supply program of Holland, through which 95 percent of the country's population has access to a public water supply. The system served by the tower is owned by the Gelderland Water Supply Co. and furnishes water to rural areas of the largest Netherlands province.

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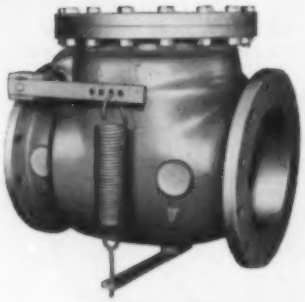

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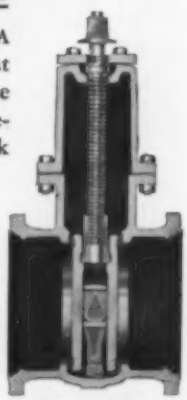
In addition to the regular line of EDDY Taper Seat AWWA gate valves, EDDY now offers a newly designed parallel seat AWWA gate valve in sizes through 12 inches. This valve has been specifically engineered to provide long, trouble-free service. Working parts are designed with heavy, thick section and large seating surfaces for dependable operation and improved wearing qualities. The valve has two-point, free-floating wedging for minimum friction and maximum operating ease. Other AWWA gate valves are available through 48 inches.



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established to evaluate the possibility of supplementing the water supply by artificial recharge of the basalt aquifer through injection wells. The public water supply of the City of Walla Walla is served from both surface and ground water sources, i.e., from Mill Creek and from four wells, ranging in depth from 789 to 1,169 feet. The maximum combined installed pump capacity of the four wells is about 7,500 gpm. Walla Walla Well No. 3, where the basalt is at least 1,169 ft. thick, was used as the injection well. About 71.3 acre-ft. of water were injected into Well No. 3 during a 26-day period of artificial recharge. Data obtained during this experimental period show that some deterioration in performance occurred; a decline both in yield and in specific capacity was noted. Three potential causes of yield deterioration have been recognized in this report: (1) sediment in the injected water; (2) dissolved air in the injected water; and (3) entrained or entrapped air that originated from leaks or undetected openings in the piping system. It is believed that the sediment content of the Mill Creek water was not an important factor in causing plugging. Neither does it seem that the dissolved air content would be likely to be released from solution and cause trouble. Entrained air being carried into the well with the recharge water may enter the aquifer interstices and cause substantial plugging. It is also possible that oxidation of the ferrous iron in the ground water by the air entering the aquifer may have a much greater effect than is now suspected. A continuation of the experiment would seem to be worth while to find the answers to this problem.

"Artificial Recharge of a Well at Walla Walla." By Robert H. Russell, Asst. Supervisor, Div. of Water Resources, State Dept. of Conservation, Olympia, Wash. *Journal AWWA*, November, 1960.

the Priceless Ingredient

The priceless ingredient theme originally was applied to medicines, and is not new. But it can be applied to other products – even valves. Of course, the priceless ingredient in a product is an invisible force, with neither shape nor form. Yet this intangible element has set M & H apart in its field and is a prime reason for the Company's growth and prestige.

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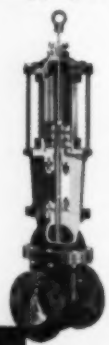

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Shenango Valley Expands Plant

The Shenango Valley Water Co. of Sharon, Pa., serving 15,548 customers in the city of Sharon and surrounding communities, has completed a $2½ million expansion program to keep pace with the community growth. The plant has been completely modernized with increased capacity, new automatic controls, reduced chemical handling costs and plans for future expansion. The major improvements and additions consist of the following: (1) New raw water pump; (2) new flash mixing equipment; (3) two new flocculators; (4) two new sedimentation basins; (5) automatic sludge removal equipment; (6) new high service pump; (7) new filters; (8) a new clearwell of 500,000 gal. capacity and (9) more than 4 miles of transmission lines. Operating costs have been decreased by electrification; the plant filtration capacity has increased from 8.2 to 14.4 mgd.; floc destruction problems due to turbulence have been eliminated; automatic sludge removal equipment has reduced maintenance costs; sedimentation overflow rates have been reduced; clear well storage has been more than doubled; problems of over-flowing basins have been eliminated; and chemical handling costs have been substantially reduced by this plant expansion program.

"Shenango Valley Water Company Expands Its Plant." By William S. Link, Supt., Shenango Valley Water Co., Sharon, Pa. *Water & Sewage Works*, November, 1960.

San Antonio's Water Program

San Antonio has telescoped into a four-year period the construction

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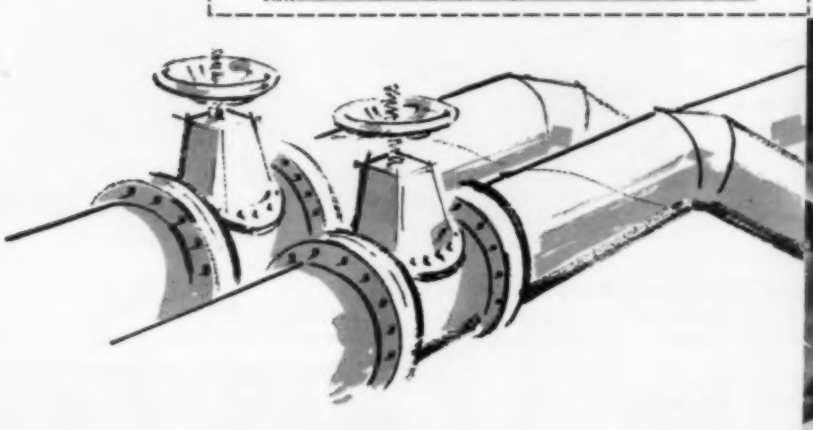

ARMCO Drainage & Metal Products

of water works facilities that have been handcuffed by fiscal law for some three decades. It has overcome its bond limitations and launched a "crash" program to catch up with the needs of a booming area. The $20,880,000 rebuilding program consisted of the following: (1) Additional wells, pumping stations, and related production facilities; (2) additional elevated storage facilities; (3) a system of trunk mains to interconnect the production and storage facilities and to distribute the water from its sources to the demand areas; (4) replacement of wornout mains, and replacement or reinforcement of inadequate local distribution mains. A major portion of the construction and rehabilitation program involves protecting newly installed trunk mains and distribution system pipes from the corrosive soils that abound in the San Antonio area. Using resistivity probes, meters and a soil auger, resistivity measurements have been made at approximately 1,000-ft intervals and at depths varying from ground surface to 4 feet. These data have been plotted on a map, resistivity contours drawn, and the areas of dangerously low resistivity shaded in red indicating that the greatest amount of corrosion would occur in those areas. At the present time, the water board has set a resistivity of 700 ohms/cm^3 as a limiting value, below which protective measures must be taken if metal pipe is to be used. Among the protective measures in current use by the water board are: (1) Asbestos-cement pipe; (2) steel-cylinder-embedded concrete pipe; (3) coating and wrapping with insulating material; (4) cathodic protection, used in conjunction with (3) above for steel piping in pump station yards; and (5) embedment of cast iron mains in a silica sand blanket. The method used in each case is dependent on the size of the pipe and the nature of the job.

"How to 'Crash' a 30-Year Need into a 4-Year Master Water Program." By Bruce E. Sasse, Chief Engineer, Water Board, San Antonio, Texas. *Water Works Engineering,* November, 1960.

New Aqueduct Supplies Four Cities

Four Oklahoma cities — Clinton, Bessie, Cordell, and Hobart—will be furnished with increased supplies of water when the 50.8-mile Foss Aqueduct is completed together with laterals and appurtenances at a cost of $3,826,244. The Foss Aqueduct project is one of the most complex water conveyance structures to be undertaken by the Bureau of Reclamation for a municipal water supply system. The source of water supply is from the Foss Reservoir which is being produced by the construction of the Foss Dam, an earth-fill structure to be completed in 1961. The design of the Foss Aqueduct is based on projected water requirements for the year 2010 for the cities of Clinton, Cordell, Bessie and Hobart. The Foss Aqueduct embraces a diversity of pipe sizes, numerous railroad and highway crossings, 3 pumping plants, 3 storage tanks, 6 surge tanks, and appurtenant features. Three laterals branching off the main aqueduct are to furnish water to the three towns of Clinton, Bessie and Cordell. The main aqueduct will be constructed of concrete pipe having diameters varying from 42 inches to 18 inches and is essentially a gravity flow system. However, three pumping plants are to be constructed to relift water at certain points in the system, necessitating storage tanks, surge tanks and other appurtenant pressure facilities. These pumping plants will be unattended. The water treatment plant for the aqueduct will have a capacity of 9 mgd and

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will provide full treatment and chlorination facilities.

"New Aqueduct Will Bring More Water to Four Cities." PUBLIC WORKS, December, 1960.

Other Articles

"Effects of **Pollutants in Water** Supplies." A panel discussion presented on May 19, 1960 at the Annual Conference, Bal Harbour, Fla. (1) Sewage and Industrial Wastes—By Ralph E. Furhrman, Exec. Secy., Water Pollution Control Federation, Washington, D. C. (2) ABS Contamination—Graham Walton, In Charge, Water Conservaiton Studies, USPHS, Robert A. Taft San. Eng. Center, Cincinnati, Ohio, (3) Taste and Odor—Herbert O. Hartung Exec. Vice-Pres., St. Louis County Water Co., University City, Mo. Journal A.W.W.A., November, 1960.

"Production Analysis of **Artificial Wells.**" A discussion of the various factors involved. By A. L. Simon, Research Asst. School of Civil Engineering, Purdue Univ., Lafayette Ind.

"Multiflash **Distillation** of Sea Water." Seventy-five per cent of the world's potable water distilled from sea water is produced by some 56 distillation plants employing the multiflash method. Process improvements lower costs. By F. C. Livingstone, London, England. Water & Sewage Works, November, 1960.

Some Applications of Elementary Solution **Equilibrium Chemistry.**" This paper presents these principles in a concise and readily understandable manner for those interested in the production of quality water. By Vaughn C. Behn, Dr. Eng., Assoc. Prof. of Civil Engineering, Univ. of Delaware, Newark, Del. Water & Sewage Works, November, 1960.

"What Water Works Men Should Know About **Saline Water** Conversion." How is it done? What are the future prospects? How much will it cost? By Allen Cywin, Chief of Demonstration Plants Division, Office of Saline Water, U. S. Dept. of the Interior and Lewis S. Finch, Vice President and Chief Engineer, Indianapolis Water Company. Water Works Engineering, November, 1960.

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World's Largest Prestressed Water Storage Tanks

The world's two largest prestressed concrete tanks are now being constructed to supplement existing water storage facilities at Springfield, Mass. The tanks measure 320 ft. in diameter by 28 ft. high. Each tank will hold 15½ million gallons of water. Floor slabs are 5 ins. thick; walls are 18 ins. thick; and the column-supported roofs will be 9 ins. thick. The prestressed concrete walls are wound with some 400 miles of prestressing wires to withstand the lateral forces which will be exerted by the water when the tanks are in service.

Prestressing was by the Preload Company. The wire was drawn from a diameter of .236 to .208 in. as it was wrapped, imparting an initial tension in the wire of 150,000 psi. The inward forces thus applied to the tanks range from 336 kips per vertical foot at the bases, which are prestressed with four layers of wire, to 28 kips per vertical foot at the tops, which have only one layer of wire. Upon completion of the prestressing operations, the wires were covered with pneumatically applied coatings of mortar. The tanks ultimately will be backfilled and covered with a 2 ft. thickness of earth.

The tanks were constructed for the City of Springfield, Mass., acting through its Board of Water Commissioners composed of Thomas J. O'Connor, Jr., Mayor; Arthur J. Stein; and Louis J. Gentile. Clinton Bogert Engineers, New York, are the consultants. General construction is a joint venture by Fruin-Colnon Contracting Co., Indianapolis, Ind. and C & C Construction Co., Ft. Wayne, Ind.

"Hardrock Smitty" says:— **IT TAKES A SMITH 125 AIR COMPRESSOR TO DELIVER ON THE TOUGH JOBS . . .**

Built to "take it" when the going get tough, the Smith 125 Air Compressor will give you years of low cost, dependable service. The Rugged Hercules Industrial engine delivers over 125 c.f.m. hour after hour, day in and day out.

LOOK AT THESE FEATURES:

- low initial cost
- low operating cost
- easy maintenance
- simple, compact design
- 12 volt electrical system
- 125 c.f.m. at 1165 rpm
- operates two 85 lb. paving breakers at same time

Compare price . . . compare job results—you'll "Go Smith" with "Hardrock Smitty"!

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Ask your dealer for an "on the job" demonstration. (write us for complete information and the name of your nearest dealer.)

SMITH AIR COMPRESSORS

GORDON SMITH & COMPANY, INC., Bowling Green, Ky.

TOWNSHIP UPGRADES EQUIPMENT SPREAD

● FRONT-mounted bulldozer blade on motor grader supplements the moldboard blade at center. Bulldozer rough-grades; moldboard blade prepares for surfacing.

WHEN A STEADY south wind begins blowing in the winter, road crews working for Charles Goodman, superintendent of highways of the Town of Plattsburg, N.Y., almost automatically start for the Cumberland Head. A several-mile long peninsula jutting into Lake Champlain just north of Plattsburg, "the Head" is infamous locally as gathering ground for a winter-long succession of man-high snowdrifts whipped-up by the south wind. In 1958 these reached heights of eight feet or more and reopening the roads required several days of round-the-clock work. It wasn't quite so bad in 1959, but "Charlie" Goodman's crews still found themselves working 24 hours or more at a stretch on "the Head's" less than five miles of road.

Although this is only a small part of the total 75 miles of township and village road for which the township has snow removal responsibility, the department's policy is to clear and open all roads as quickly as possible.

From this year on, however, the Plattsburg township road crews expect to spend less time on Cumberland Head, even if snows reach the 1958 levels. Main reason for this optimism is an upgrading of equipment carried out late last winter which saw a nine year old, 50 horsepower No. 212 Motor Grader replaced by a new, 150 hp Cat No. 14 Motor Grader.

"I know it seems like an awfully big step from the No. 212 to the No. 14," Goodman comments, "but we need a machine that big." Town Supervisor, Bernard Amell, agrees. "The initial cost of this large a unit becomes less significant when you have a job that simply has to be done and done as quickly as possible." They also agree that the snows of '58 and '59 clearly indicated that "the Head" claimed a disproportionate share of work to clear and keep open in winter.

"As much as anything, though," Amell states, "the decision to move up to a big motor grader was brought about through a recognition of a year-round need for equipment with higher productive ability."

Although snow removal is perhaps their prime problem, the township highway department also carries out an extensive road building, repair and maintenance program during warm weather months. During this past summer it has built six miles of all new road in subdivisions, paved nearly eight miles of dirt road with bituminous concrete, rebuilt another five miles of blacktop, all in addition to ordinary grading of dirt roads, shoulder shaping and ditching and patching existing bituminous concrete pavements.

Fitted with an hydraulically-controlled, front-mounted dozer blade, the No. 14 tackles jobs formerly saved for the township's Cat D4 tractor. "We've even used the No. 14 to knock down stone walls and small trees . . . though we don't really approve of using it that way," comments Amell. A more common, and approved, application is spreading of fill for a sub-base or light dozing with the bulldozer blade and fine grading with the moldboard all in one pass. Another big use is mixing of the approximately 400 tons of bituminous material and crushed rock used each summer for patching and new pavement.

When bids for a replacement to the No. 212 were opened last February, the town board was surprised to find the high trade-in price commanded by the nine year old grader. Despite its more than 9,000 hours, and an original price of $9,-200, one bidder offered $9,000 trade-in. In choosing the No. 14, the board rejected two lower bids (the No. 14 was $5,600 above low bid), explaining, "In awarding a contract, quality, maintenance, depreciation and resale or trade-in value must be considered as well as low bid."

Discussing the board's decision, Amell defined low bid as falling into two categories: 1) Lowest figure in the tabulation of bids received or 2) the lowest figure based on the concept of quality.

"According to New York State Municipal and Highway Law," he continued, "public officials can buy quality equipment only by drawing detailed specifications to ensure that all bidders must be equivalent with their product. The law forces them to buy their equipment based on the price-tag determined by competitive bidding. The reason for such legal restrictions is obvious.

"Public funds must have protection but the price-tag protection breaks down and can become self-defeating when applied to modern construction equipment.

"The exclusive consideration of initial cost of a complicated piece of machinery that must be used, serviced, maintained and repaired for several years results in a miscarriage of legal safeguards."

Annual budget of the highway department is nearly $50,000, of which $8,000 is allocated for snow removal and $9,000 is earmarked for machinery purchases, repairs and maintenance. An average work force of 10 men is expanded to 14 during special periods of construction or snow removal. The equipment spread includes, besides the D4 Tractor and No. 14 Motor Grader, three International dump trucks and one Dodge and one GMC truck which are fitted with plows for snow removal.

SMALL AIR TERMINAL BLENDS ECONOMY WITH EYE APPEAL

YOU KNOW a city by its airport in this jet age when more and more visitors arrive by air route. Most large cities are building vast, super-airport facilities costing millions but smaller cities are discovering they can have big-city luxury in their air terminals at economy prices.

A classic, small city air terminal in the smartest modern design, which may well set the standard for small terminals of the future, has just been completed at Klamath Falls, Oregon, at remarkably low cost.

This beautiful structure, with its upswept roof line designed in long, graceful glulam timbers and its large wall areas of glass, compacts within its 10,050 square feet all of the facilities to serve air passengers and cargo for this city of 20,000 and the 100,000 people in surrounding communities.

Modern design is the key to the beauty and functionalism of this airport. Architects Morrison, Howard and Starbuck of Klamath Falls used glued laminated Douglas fir members in the skeleton framework for the columns and beams, which helped keep the construction costs of this stucture to 11/sq. ft.

Seven cambered 67-ft. long glued laminated beams, fabricated by Timber Structures, Inc. and spaced 21 ft. on centers, form the roof system and are set on glued laminated timber posts. The great flexibility of these timbers is well illustrated in these beams which are 9-in. wide and taper from 42-in. deep in the center section to 15-in. deep at the end of the roof overhang. They are 24 in. deep where they are fastened to the 9 by 9¾-in. columns at the wall line.

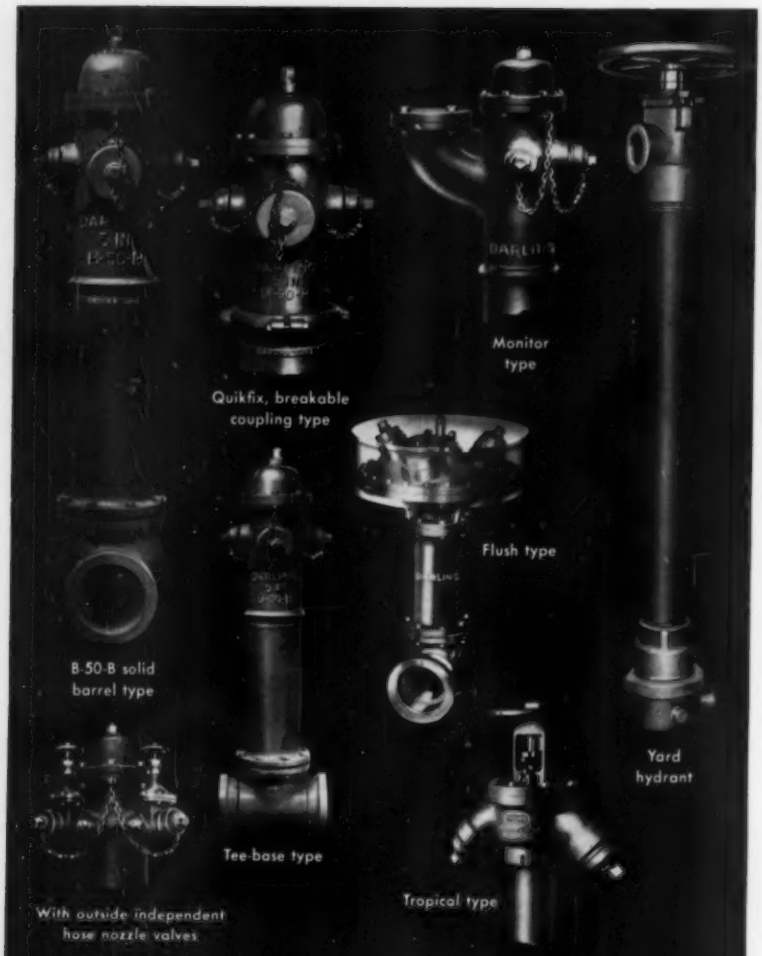
Tim-Deck, a 4-in. thick double tongue-and-groove roof deck, was laid directly on the roof beams and both beams and decking have been left exposed to give charm and character to the building.

The air terminal is 50 by 128 ft. in size and a restaurant and cocktail lounge occupy a balcony level. An ingenious structural system was used in the design of the balcony, which is supported by a series of 7 by 16½-in. glued laminated beams that are hung by steel rods from the roof beams. Heavy 4-in. wood decking makes up the floor of the balcony and both decking and beams have been left exposed so that the texture and coloring of the Douglas fir supplies much of the decorative motif in the main floor waiting room.

By using the heavy glued laminated beams, no posts are required within this building. The large lobby area occupying nearly half of the total floor space is spacious and unencumbered, giving a feeling of friendly roominess in this public room. Ticket offices, two large cargo handling rooms, F.A.A. offices, airport manager offices, large rest rooms and the furnace room occupy the balance of ground floor space.

● **LOUNGE is an attractive place. A good view of the runway and landing areas is provided through the glassed wall.**

● **POST and beam framing system of glued laminated members allows a post-free construction in the open lobby area.**



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provide exactly the right type for special or unusual service needs

Above you see some of the many types of hydrants in the complete Darling line. With this wide selection, your system can include *exactly* the right types for special or unusual needs... all with unmatched Darling quality.

Darling's unique B-50-B design provides *ball-bearing* operation combined with "O" ring seals. This provides a packless, dry-top hydrant with no packing gland maintenance. Operating threads and bearings *stay* lubricated and water can't reach them.

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Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

Restaurant, lounge and kitchens take up all the space on the balcony level. Two wide stair systems serve the balcony.

Wide roof overhangs of projected beams and decking along the front of the building not only add charm to the terminal, but protect the glass from sun and rain. Diners and lounge customers have an unobstructed view of the runways and landing ramp from their balcony vantage point viewed through the glass walls.

"We wanted to give Klamath Falls an air terminal its citizens could be proud of," said Architect John R. Howard. "We felt that by using glued laminated members for the basic framing system and heavy wood decking we could provide a completely safe, beautiful and economical structure. This we accomplished, as the cost of $11.00 a square foot will indicate."

Interior walls are plasterboard over wood frame and the plasterboard walls of the restaurant have been decorated on the lobby side with distinctive air-age murals. An interesting pattern has been used in the vinyl asbestos floor covering over the concrete slab floor. Both incandescent and fluorescent lighting have been combined to give maximum light throughout the building. Perimeter warm air heat is supplied from the oil fired furnace. Total volume in the structure is 106,100 cubic feet.

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Jug-Handle Intersections Lighted by Fluorescent Luminaires

Key intersections along a 36-mile strip of New Jersey US 1 have been equipped with GE fluorescent luminaires. The section from Woodbridge south to Trenton is under a single traffic control featuring 30 "jug-handle" intersections lighted by two-lamp and four-lamp six-foot luminaires. Average daily traffic is more than 15,000 vehicles.

The level of illumination is calculated to be one-half a footcandle, about 25 times the brightness of a full moon. The luminaires are mounted on aluminum poles 25 feet above the roadway. There are five such installations at each intersection. Power to the lighting units is supplied via underground wiring by New Jersey Public Service Gas and Electric Co. Maintenance will be performed by the State Highway Department, which installed the units. It is expected that the lamps will be replaced once a year.

Sewerage Developments in San Francisco

Following studies during the 1959 fiscal year, by the Engineering Department of the City and County of San Francisco, new standards were adopted, or were in the process of being adopted, for catchbasin gratings, vitrified clay pipe sewer joints and centrifugally spun reinforced concrete sewers.

Because of superior inlet characteristics, a catchbasin grating with bars and openings parallel to the line of flow was in the final design stage at the end of the fiscal year. Polyvinyl-chloride joints for vitrified clay pipe sewers, which provide more flexibility and water tightness, were adopted and specified in contracts during the fiscal year. Inasmuch as centrifugally spun reinforced concrete pipe with bell ends was made available through the larger sizes of pipe up to 72-inch diameter, bell and spigot joints for this type of pipe, in preference to the tongue and groove type joints, were standardized and used.

Efficiency of sewer repairs was materially improved during the year through the acquisition of a combination back-hoe and front end loader. This not only permits the saving of money on certain types of excavations but also reduces traffic hazards by speeding up the work in street excavations.

A program was instituted of photographing the interior of main sewers which cannot otherwise be inspected in order to determine their condition. About three miles of the North Point main sewer from 10th and Harrison Streets to the North Point Sewage Treatment Plant were thus photographed. This sewer varies in diameter from 7′ 6″ to 8′6″ and carries the flow from a large portion of the City. Due to the extreme dangers of entering this sewer, it had not been adequately inspected since its construction over fifty years ago. The results of the photographic work indicate that the sewer is generally in good condition. A location was discovered in the vicinity of Seventh and Howard Streets where the sewer had settled as much as three feet, apparently due to the general subsidence of the area. Although the photographs did not disclose any severe structural distress resulting from this settlement, the location should be carefully watched and occasionally repnotographed because a major sewer failure at this point could prove disastrous.

K-S
ELECTRONICALLY CONTROLLED PNEUMATIC SEWAGE EJECTORS
with the new Komline-Sanderson
LIQUID LEVEL CONTROL
uses only 1 Single, Short Probe
The finest, most reliable pneumatic sewage ejectors are now equipped with the most advanced innovation in electronic liquid level control, a development of Komline-Sanderson research. K-S electronic liquid level controls provide:
■ Completely transistorized control systems.
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■ High water alarm incorporated in the design.
■ Single, short probe that does not require cleaning.
Also available for installation on your present ejectors.
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MECHANICAL EQUIPMENT DIVISION
KOMLINE-SANDERSON ENGINEERING CORPORATION
PEAPACK, NEW JERSEY
CANADIAN OFFICES AND PLANT
BRAMPTON, ONTARIO, CANADA

THE
INDUSTRIAL WASTE DIGEST

Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

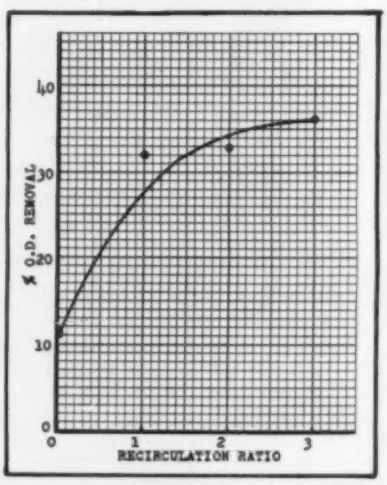
Biological Treatment For Color Removal

The color of beet waster becomes an objectionable polluting characteristic if it reaches a wasteway without appreciable change. A research project was undertaken to determine if conventional high-rate trickling filters would remove beet color, produced by the presence of betanin, when the waste is treated with domestic sewage. The studies included determining the threshold of color discernibility, by using four observers. The evalution technique used determined optical density by means of a spectrophotometer. Bench scale and pilot investigations were employed. It was found that high rate filters do not provide adequate treatment, but color removal is enhanced by increasing the recirculation ratio and by decreasing the loading. The color can be removed by large amounts of chlorine or by lime treatment. In case of the latter, sludge disposal would be a problem.

"Color Problems with Beet Waste." By R. E. Pailthorp, Cornell; Howland, Hayes and Merryfield, Consulting Engineers. *Journal WPCF,* November, 1960.

Spray Irrigation For Cannery Waste

The variable composition of the food processing waste of the Gerber Products Co. at Fremont, Mich., makes it difficult to treat by any one process. When information on spray irrigation as a disposal method started appearing in the literature, it was decided to study its feasibility for the Michigan installation. An experimental plot which included acreage under cultivation was leased. This was later moved because operations had to be abandoned to permit harvesting. The success of the experiments at the new site prompted a full scale installation of 140 acres in an area where sandy surface soil is at least 50 feet deep. A lagoon was used for winter storage. The waste is pretreated by shaker screens and is discharged to a 30,000 gallon storage tank from which an automatically controlled pumping arrangement supplies the irrigated area. The distribution system consists of an 8-in. galvanized steel main and 4-in. aluminum laterals. Each lateral is equipped with 5 risers and sprinkler heads at 120-ft. intervals. Four species of trees were planted, Cottonwoods, Box Elders, Balsam Poplars and Willows. These were irrigated at a rate of 2 in. per week. Experiments were also made with cover crops, such as beans, squash, peas, beets and carrots. The investigations with these and the trees were successful. The remainder of the waste was applied to 30 acres of alfalfa. The suspended solids content of the waste varies from 200 to 3,000 ppm and BOD, 800 to 3,000 ppm. The pH is neutral most of the time, but varies between 4.5 and 11.5. For a while, difficulty was experienced in maintaining operations during winter. This was solved by limiting the irrigation to small areas under conditions that would keep the soil from freezing. Test wells in the vicinity have shown that the practice has no effect on ground water. Two operators are required, each taking an 8-hr. shift.



Courtesy Journal WPCF

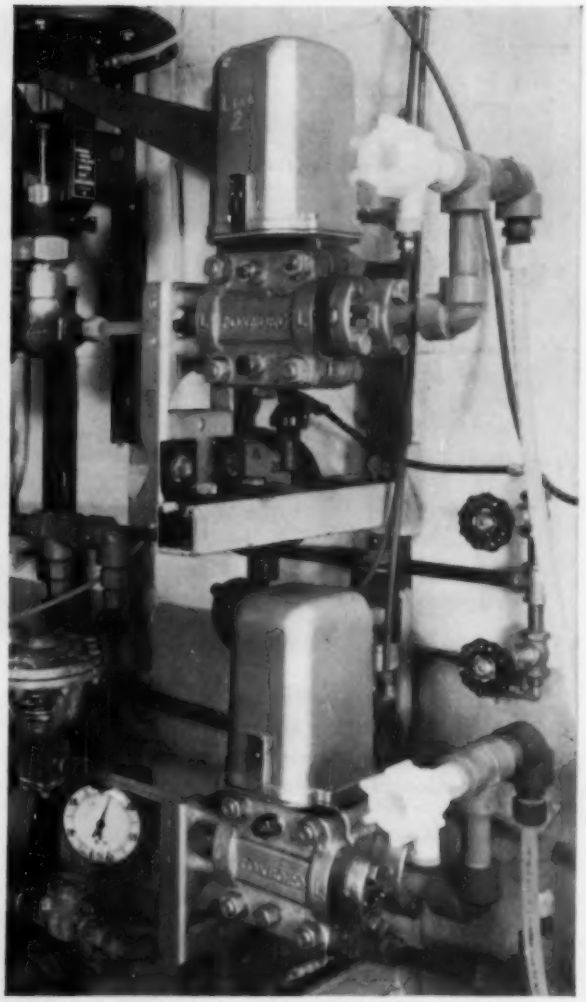
● **EFFECT of recirculation on color removal as indicated by optical density.**

"Cannery Waste Disposal by Gerber Products." By Max R. Dietz and Ray C. Frodey, Gerber Products Co. *Compost Science,* Autumn, 1960.

Distributing Costs Of Joint Treatment

The expansion of industry and increase in population will call for higher degrees of treatment of wastes to avoid exceeding the fixed assimilation capacity of the Nation's waterways. The continuing necessity to obtain capital for production purposes will impose limitations on funds expended for waste treatment. These economic pressures will place future emphasis on economical treatment plant designs and on community-wide efforts at solving problems. Standard designs must give way to obtaining treatment flexibility to meet diversification of industry. In designing a joint industrial-municipal wastes treatment system in the Midwest, extensive investigations and pilot plant studies were undertaken to establish annual costs of various secondary treatment and sludge disposal facilities. The investigations compared costs of treating the components of the wastes separately and jointly and also recognized the differences between municipal and industrial financing practices. The studies resulted in the design of a joint plant at an estimated capital costs savings of $3 million and $250,000 in annual costs. A rate structure was developed to place the project on a self-liquidating basis and to provide financing methods independent of the general ob-

Foxboro M/40 Ratio Controllers regulate exact amount of liquid alum being added to raw water.



8% AL_2O_3 flows right through the Foxboro Integral Orifice d/p Cell. There are no pressure taps — nothing to bind or plug up.

Problem of metering liquid alum solved with the Foxboro Integral Orifice d/p Cell* Transmitter

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WORLD'S LARGEST MANUFACTURERS OF FINE PARK, PICNIC, PLAYGROUND, SWIMMING POOL AND DRESSING ROOM EQUIPMENT

ligation of the community. The studies permitted allocating capital costs according to flow, BOD and suspended solids. Both industry and the municipality "purchased" sufficient portions of the hydraulic, biological and solids treatment capacity of the system to provide for anticipated future wastes contributions.

"How to Make Sewage and Industry Wastes Systems Work." By Ernest W. Whitlock and Thomas P. Quirk, Malcolm Pirnie Engineers, New York. *Wastes Engineering*, November, 1960.

Formulary of Biochemical Stabilization

A review is presented on available data in published and unpublished form concerning the susceptibility of the more resistant organic chemicals to biological destruction; in this, an attempt has been made to relate behavior to chemical structure. The accumulated data are presented as tables classified according to the chemical structure of the compounds. In each case, the method of biological attack (activated sludge, BOD, etc.), the temperature, period of observation, feed rate, days of acclimation, percent theoretical oxidation, percent removed and source of data are given. The chemical structure classifications include hydrocarbons; alcohols; phenols; aldehydes; acids, esters and salts; ethers; ketones; amino acids; nitrogen compounds; cyanides or nitriles; compounds containing the vinyl group; oxy compounds; and surfactants and allied structures. A table is also included on cross acclimation. Many compounds do not appear susceptible to metabolism. These include high molecular weight materials and tertiary-branched structures. The tabulated information can form a basis for predicting waste behavior, which predictions can be primarily useful for preliminary estimates and to guide research.

"Chemical Structures Resistant to Aerobic Biochemical Stabilization." By F. J. Ludzack and M. B. Ettinger, Robert A. Taft Sanitary Engineering Center, *Journal WPCF*, November, 1960.

Researching Industrial Wastes

The research and development approach to solving complex waste disposal problems offers insurance against costly mistakes. This is done by: 1) Defining the wastes as to source, quantity, characteristics and effects on receiving stream uses;

2) deciding what the solution to the problem should accomplish; and 3) determining the design by evaluating these in the laboratory and by a pilot plant. The laboratory evaluation should involve consideration of the applicability of unit processes. These would include susceptibility of wastes to physical separation methods—gravity differential of solids and immiscible fluids, flotation, screening and filtration. They can be evaluated for solids concentration and dewatering—thickening by gravity differential, flotation or centrifuging; filtration dewatering. The use of mass transfer can be investigated—oxygen transfer, adsorption, ion exchange, extraction and distillation. Chemical treatment may have possibilities—neutralization, coagulation, flocculation, oxidation, reduction and sterilization. Biological treatment possibilities should include trickling filters and activated sludge. In the laboratory, where processes are applicable, design criteria can be developed and bench scale equipment is somewhat standardized for these studies. If the large-scale facility will cost only a few thousand dollars, pilot plant studies are normally not justified. Variability of a waste makes them important, however, and material balances are more accurately determined by a pilot plant than in a laboratory. They are also justified when supplementary studies are to be made, such as on sludge disposal or by-product recovery.

"Research—Key to Effective Industrial Wastes Treatment." By Roy F. Weston and Vernon T. Stack, Jr., Roy F. Weston, Inc., Consulting Engineers. *Wastes Engineering*, November, 1960.

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Signal Davits Were Made by Kerrigan

An article on page 146 of the December issue described streamlined signal davits used on U. S. Routes 90 and 287 near Beaumont, Tex. Unfortunately the name of the manufacturer, Kerrigan Iron Works Co., Nashville, Tenn., was omitted from the article.

Street Cleaning Costs

A total of 35,988 machine miles were cleaned by the six street sweepers operated by Fort Worth, Texas, during the year ending Sept. 30, 1959. Costs ranged from $1.38 to $1.78 per mile for the sweepers and from $1.33 to $1.67 per mile for pick up.

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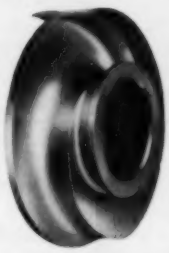
"The Pump with the single passage impeller"



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The Mono-Vane impeller is in hydraulic and dynamic balance. It can be trimmed to suit various head and capacity requirements and still retain proper balance. The AURORA Non-Clog Pump is ideal for handling long stringy materials. Smooth, quiet operation is assured with the Mono-Vane impeller which is always in dynamic and hydraulic balance—even when trimmed to accommodate various head and capacity requirements. Single passage impeller design makes the AURORA Non-Clog pump ideal for handling long stringy materials. The discharge may be turned to any position to facilitate installation, service and maintenance. Clean-out cover is located in casing to provide easy service access.

Typical applications: elevating sewage, pumping sludge, handling heavy settleable solids, effluent, and other wastes and industrial by-products.

WRITE FOR BULLETIN 121 MV

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STORM WATER DETENTION IN URBAN AREAS

EUGENE J. DAILY
Partner,
Clark, Dailey & Dietz,
Consulting Engineers

An abstract of a paper presented at the 8th Annual National Highway Conference held at Atlanta, Georgia.

DETENTION of storm water to limit the rate of runoff to the capacity of existing channels or to reduce the cost of channel improvements or other protective works is a well established procedure. However, few applications of the detention principle have been used to control runoff from urban areas since major concern for drainage problems usually occurs only after an area has been partially or fully developed. Then the developments themselves preclude the economical installation of detention facilities. This need not be true if there is adequate advance planning.

While the development of detention facilities will be more costly in an urban or potentially urban area than in a rural section, the potential benefits also are greater. There is more roadway drainage, for instance; but of even more consequence is outlet, collector, and lateral storm sewers required for a satisfactory urban community. The cost of outlet and collector sewers, exclusive of laterials and detail drainage in accordance with accepted conventional procedures, is from $1,000 to $2,000 per acre. This can amount to over a million dollars per square mile. If the storm water were detained near its source and conduits provided to carry off the water from a design storm in 12 to 24 hours instead of as it falls, a savings which could be as much as 75 percent could be realized in the cost of the collector and outlet sewers. In addition the outlet channels below the urban area would be relieved of much of the overload, resulting in additional savings.

Our firm has, at the request of the County Commission, made feasibility studies of detention facilities in that part of Shelby County, Tennessee, adjacent to the City of Memphis. This area is now in the process of urbanization. Shelby County has three sizeable streams, two of which go through the edges of the present city and the third through an area now undergoing development. The main stems of these streams and especially the south one, Nonconnah Creek, present flood problems which are compounded by the increase in rate of runoff due to urbanization within the basins.

One specific study was concerned with the upper 3500 acres of the Day's Creek watershed. Extensive residential and some commercial developments have already taken place in the area. There are only about 900 acres of the 3500-acre watershed for which detention facilities appear practical at this time. The cost and effect of eight detention basins with drainage areas of from 30 to 450 acres for these 900 acres of watershed were considered. The total cost including land was estimated at $145,000 or approximately $160 per acre of watershed controlled. Savings in the construction cost of drainage facilities within the immediate vicinity of the basins, with no allowance for benefits to the lower reaches of Day's Creek or Nonconnah Creek, were $470,000 or about three times the cost of the detention facilities.

An additional specific study was made in connection with the preliminary engineering for a 15-mile section of a major Shelby County road. The county had requested us to ascertain the potential savings in the cost of drainage structures for this section of road for which the ultimate plan is a divided and limited access facility. All reasonably feasible detention sites were considered. Because of the present state of development, detention facilities were not considered for some of the watershed areas. The total area draining across this road is approximately 12,000 acres. It appears practical to provide detention for the runoff from 8,200 acres or about 2/3 of the total. These 8,200 acres would be controlled by 44 detention basins.

The total cost of these detention facilities was estimated at $1,400,000 or about $175 per acre controlled. They would save $350,000 or one-fourth of this total in the lowered cost of drainage structures for the 15-mile section of road under consideration. In addition there would be an estimated saving of $2,000,000 in the cost of drainage facilities eventually required upstream of this road. No estimate was made of saving for drainage structures for other roads downstream or for urban drainage or outlet facilities downstream.

It must be realized that if such a project were adopted, most of the cost of the control facilities would be immediate while the cost of the drainage facilities otherwise required would be spread over a number of years as the development takes place. Also, to complete the economic picture, the cost of maintenance, both added and reduced, must be considered.

One of the streams studied goes through the Municipal Airport down stream from the road under study. The drainage structures on this stream within the airport were designed for a rural condition and thus will become inadequate as urbanization of the watershed proceeds. It appears feasible at this time, before further development takes place, to provide sufficient detention facilities to restrict the anticipated flow of the stream to the capacity of the existing structures, thus eliminating the need for approximately $1,000,000 in drainage improvements which will otherwise be required. The cost of the detention facilities is about $250,000, part of which is in the figure for the road study previously cited.

In the Shelby County studies, the detention basins were proportioned to retain about 60 percent of a six-hour rainfall having a return frequency of 100 years with an outlet sufficient to empty the basin in 24 hours. This of course, is a much larger storm than is used for the design of conventional storm sewer systems where a return frequency of 5 to 10 years, but in a few instances as much as 50 years, is used. It is proper to use this larger design period because when the capacity of the basin is reached the excess flow over the emergency spillway is going to an outlet smaller than in a conventional system. Because of the difference in design

periods, there is a range of floods which the detention system will completely accommodate, whereas the conventional system will not. However, there is a range somewhat beyond the 100-year figure where the resultant conditions could conceivably be worse with the detention basins. In considering this aspect, it is well to realize that a 100-year flood is about twice as large as a 5-year flood, so that at the point an emergency spillway would start to function, a conventional system would already be overtaxed to twice its capacity. So, for floods larger than 100-year frequency, there will ordinarily be a serious flooding problem regardless of the type of drainage system.

It was assumed that the emergency spillway should accommodate the flow produced by a 100 percent runoff from the maximum 6-hour point rainfall as determined from curves developed by the U. S. Weather Bureau. The embankment should have a freeboard of 1 to 2 feet above the maximum water surface of the emergency spillway design. It would be wise to plan the downstream streets and other features so that overland flow can occur without undue damage. As previously indicated, for such unusual flood conditions, there is going to be damage with or without detention basins.

The effect of the detention basins on the surrounding community should be considered in addition to the simple dollar economics of drainage alone. It is easy to think of several undesirable possibilities but whether the basins will be liabilities or assets to the community will depend to a very large degree on the planning not only of the basin itself, but also of the surrounding area, and the provisions for maintenance. For larger watersheds it would be practical to provide permanent pools of sufficient size and depth for recreation purposes and for storage of silt. For smaller watersheds permanent pools would probably be a nuisance, so they should be designed as dry basins.

It would be feasible to landscape and use most of the basin area most of the time. An approximate relation between percentage of basin covered and frequency indicates that 2/3 of the basin is covered only once in 10 years and 1/3 of the basin only once per year. If the development of surrounding areas were planned around the detention sites they could become a desirable green area enhancing the value of the whole community. Such areas would be compatible with the principle of cluster development which is being proposed in many communities. Detention basins would give the open spaces which result from cluster development an added purpose without affecting the potential number of building units.

Silt is another factor to be considered in connection with detention. In an urban circumstance silt will be of greatest concern during the period that an area is under active development. After pavements, lawns, and storm drainage are in place, silt should not be too serious a problem. In some cases it may be practical to provide storage for silt but in most cases for small watersheds it will be necessary to remove the silt. While removal of silt is not ordinarily an economical way to restore water storage capacity, it does appear entirely feasible in the urban circumstance where both land values and benefits are high.

If such facilities are to be widely adopted for urban areas, there is a need for the development of uniform standards and design criteria for such things as: Runoff, spillway design, siltation rates, and details. The Soil Conservation Service and others have developed a large amount of pertinent data which is very helpful but which is not specifically applicable to the urban situation.

To summarize, the studies made to date indicate that with proper planning and suitable topographic conditions the principle of detention can be used as an economical and acceptable part of the storm drainage facilities for storm water from urban or suburban areas. A significant part of the benefits will accrue to road drainage structures and other public works, but a larger part will usually accrue to the area drainage costs which are often assumed by the developer or otherwise assessed against the benefited property. There is a need for the development of uniform standards and design criteria.

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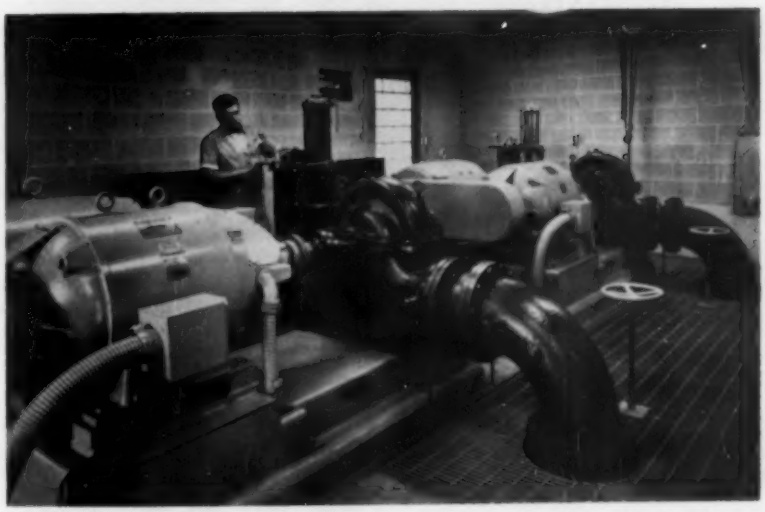

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Electric System Construction Budgets

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ELECTRIC utility system management is faced, each year, with the need to predetermine the nature, the extent, the desirability, and the cost of system improvements which must be planned, designed, constructed and financed if adequate and reliable service is to be maintained commensurate with anticipated load growth during the ensuing year. Closely allied with the required construction program relating to power plant additions, substation extensions, and improvements in the transmission of distribution facilities are improvements which provide economy in system operation and management of the business.

In this regard, the construction budget might include the purchase of an automatic billing machine, the construction of a demonstration kitchen or the establishment of an outlying pole yard and warehouse (desirable for more efficient conduct of the business), as well as the addition of a generating unit, the construction of a new substation or the extension of pole line feeders and underground network circuits to serve new and growing loads.

Due to the complexity and diversity of items in the annual budget, it is desirable to give as much time and advance planning as possible to the coming year's construction program. If the members of the utility's engineering staff anticipate system requirements several months in advance and solicit budget requests from the generation, transmission, distribution, and commercial departments throughout a given year, it is possible to coordinate the overall construction program for the next year and to estimate the costs with reasonable accuracy. This might not be the case if individual budget items were assembled in a last minute rush.

One procedure which has proven satisfactory in practice leads to soundly planned annual budgets well in advance of the construction requirements for the following year. In this procedure, the engineering division sends out requests in July to each department of the utility, asking for estimates of their department's items to be included in the construction budget. These estimates are accompanied by a discussion of the purpose and necessity for each expenditure, and the costs are broken down by months to establish cash flow requirements.

The engineering staff's requests include a timing schedule for each step in the preparation of the construction budget, somewhat as follows:

October 15th: Final date for submitting items to be included in the budget.

October 31st: Meeting with management to discuss items proposed in the budget.

November 10th: Meeting with construction and additions committee to discuss the budget.

November 30th: Completed budget ready for distribution.

December 15th: Meeting of Power committee of Board of Directors to act on approval of construction budget.

In a timing schedule such as the above, a full two-month's time is allowed for selecting the numerous items that made up the final budget on which necessary design, financing and construction work is to proceed during the ensuing year.

Individual utilities have construction problems and methods peculiar to themselves; however, a construction budget may, in general, be divided into seven major categories similiar to the following:

Group A-Engineering and Overhead: Items in this group provide for engineering and overhead expenses to be charged against construction during the year. Rather than using a flat percentage, such as, say, 15 percent of construction cost for these expenses, the cost of engineering and overhead expense is estimated for individual construction budget items and summarized in this group. By so doing it is possible to provide a more realistic esti-

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mate. Some expenses, such as the preparation of specifications for a substation transformer, may be less than a flat blanket percentage. Others will be more than an average percentage such as the preparation of plans and specifications for a complicated turbine foundation or underground duct bank system.

Group B — Uncompleted Work: This group includes items covered in the previous year's budget which were not completed in that year, but are still in the process of construction.

Group C—Revenue Construction: Items in this group include local construction necessary to serve new residential, commercial, and industrial consumers, and the increased requirements that develop during the year for existing consumers. Such items include rural line extensions, overhead, underground, and street lighting construction, watt-hour meters, and distribution transformers.

Group D—General Distribution System Improvements: This group covers expenditures required to provide additional distribution system capacity between the power sources and the local construction provided in Group C, including new substations, increased capacity in existing substations, new trunk main distribution feeder pole lines, static capacitors, voltage regulators, and related improvements.

Group E — Miscellaneous Construction and Replacements: Items in this group include miscellaneous capital expenditures required in connection with revenue construction, general distribution system improvements, and generating station additions, as well as the replacement of facilities which have to be replaced due to new construction. This group also includes building improvements, transportation and office equipment, the cost of facilities provided to improve service, and contingencies which cannot be foreseen at the time the construction budget is prepared.

Group F—Future Construction: This group covers authorization for making purchases of equipment to be delivered and paid for during the period beyond the budget year, but for which authorization is necessary at the time the budget is prepared. Items in this group include long-delivery equipment and construction work requiring considerable time for engineering, purchase of sites, preparation of foundations, etc.

Group G—Additional Generating Capacity: This group covers capital expenditures for major extensions and additions to generating stations as required to provide capacity for system load growth.

For each of the construction budget items, the total estimated construction costs are tabulated by individual budget items numbers in columns designated: "prior to year", "during year", "after year", and "total for project". The summation of the amounts tabulated in the "during year" column represents the funds to be expended within the construction budget year, and the "total for project" column determines the amount of financing which will be required to complete the work contained in the construction budget.

• • •

Yale Traffic Fellowships Available

The Bureau of Highway Traffic at Yale University has announced the availability of fellowships for the 1961-62 academic year to be awarded to qualified graduate engineers who are citizens of the United States and would like to enter the profession of traffic engineering as a career. The fellowships cover a full academic year of graduate study, starting in September, 1961 and terminating the following June.

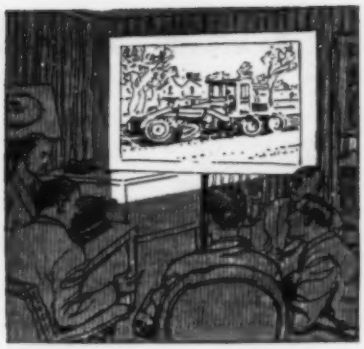
The Bureau also offers tuition scholarships to qualified municipal and state highway engineers who will receive financial aid from their employers while undertaking the graduate work. This arrangement is considered by many employers to be a form of in-service training.

Applications for admission and further information may be obtained by writing to Mr. Fred W. Hurd, Director, Bureau of Highway Traffic, Yale University, Strathcona Hall, New Haven, Connecticut. The closing date for filing applications is March 1, 1961.

Highway Lighting at Unusual Levels

Continuous lighting to an average of three footcandles maintained is provided on the entire route of a new four-lane divided highway between Rotterdam and The Hague in the Netherlands. This is at least three times that of the highest level of lighting used in the United States.

The new Dutch highway has no speed limit. Lighting is from four sodium lamps mounted on 40-foot poles located in the center dividing strip. This delivers some 85,000 lumens per pole, compared with U.S. practice of 20,000 lumens per pole.



FILMS in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"Heavy - Duty Highways With Hot-Mix Asphalt." Shows how materials are obtained, assembled and complete plant operation for asphalt highway construction. (24 min., color, sound, 16 mm.) The Asphalt Institute, College Park, Md.

"The Smiths Make the Right Connection". How connections to main sewer line can be made using Transite sewer pipe. (16 min., color, sound, 16 mm.) Motion Picture Department, Johns-Manville Corporation, 22 East 40th St., New York 16, N. Y.

"Space, Time, and Steel." The production and erection of various types of buildings produced by Armco for the industrial and farm markets. (25 min., color, sound.) Armco Steel Corporation, attn. E. E. Wilkinson, Production Section, Advertising Dept., 703 Curtis Street, Middletown, Ohio.

"1/3 Mile Per Hour." The story of how a road can be built in six hours construction time using a P & H Soil-Cement Stabilizer. (14 min., color, sound, 16 mm.) Harnischfeger Corporation, 4400 West National Ave., Milwaukee 46, Wisconsin.

"Airways to Fair Taxes." Describes how detailed aerial tax maps are used by assessors, traffic engineers, public works officials and county engineers. Step by step production of the maps is covered. (20

(Please turn to page 154)

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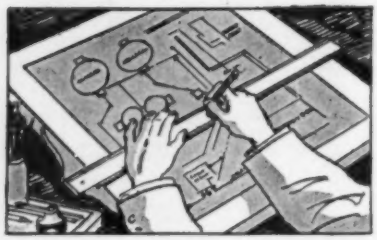

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(Continued from page 151)

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ERROR IN "DESIGN OF SMALL WATER SYSTEMS"

I recently had occasion to review the May, 1960, article "The Design of Small Water Systems." There is an error in the equation for computation of total annual cost, page 120 or page 14 in the subsequent reprint, which apparently crept in during the printing operation. The formula should read:

$$S_c i = Ci + O + i\frac{(C - \text{salvage})}{(1+i)^n - 1} + \frac{Ri}{(1+i)^x - 1}$$

Although the error is an obvious one, I thought that it should be called to your attention.

The response to the article has been very gratifying and I hope that you have found it successful.

J. A. Salvato, Jr.
P. E., Director
Div. of Environmental Hygiene

TOO MANY SIGNS CAN CONFUSE

Your article in the Oct., 1960, issue (Page 118) "Making a Traffic Sign Inventory" does not state that reflectorizing can be a problem. Also that too many signs in different colors, shapes and heights can be confusing and unesthetic and detracting to a community.

The problem of uniformity cer-

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Murray Spack,
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YES—WE HAVE AN ANNUAL INDEX

Your very fine publication, PUBLIC WORKS, has been selected by the Arizona State Highway Department to be bound and retained in the technical library.

We are particularly interested in knowing if you publish a yearly index of the subjects covered and if it is possible to get some of the issues missing from our files.

Thanking you for any information and assistance you may be able to give us in this endeavor.

Warren J. Hile
Records Coordinator
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ANSWERS TO TIMEWASTERS

Since reading your February, 1958, issue considerable time has been spent on your "timewasters" by fellow employees in the office in which I work. I would very much appreciate, if still available, receiving your solutions to the various problems.

I have enjoyed "wasting" time with these and also read many of the articles you have published.

A self-addressed stamped envelope is enclosed for your convenience.

A. Reader
Downey, Calif.

THANKS MR. GUSTAT

This is to inform you that I have retired from my position as Superintendent of the Water Department of Johnston City as of Oct. 1, 1960. I have been on this one job as Superintendent for 35 years, and have been a reader of PUBLIC WORKS nearly as many years.

I am using this means to thank you for all these years of service, and I do mean it has been service, and a pleasure to me. I cannot speak too highly of your wonderful PUBLIC WORKS, it has been a real help to me. Thank you again.

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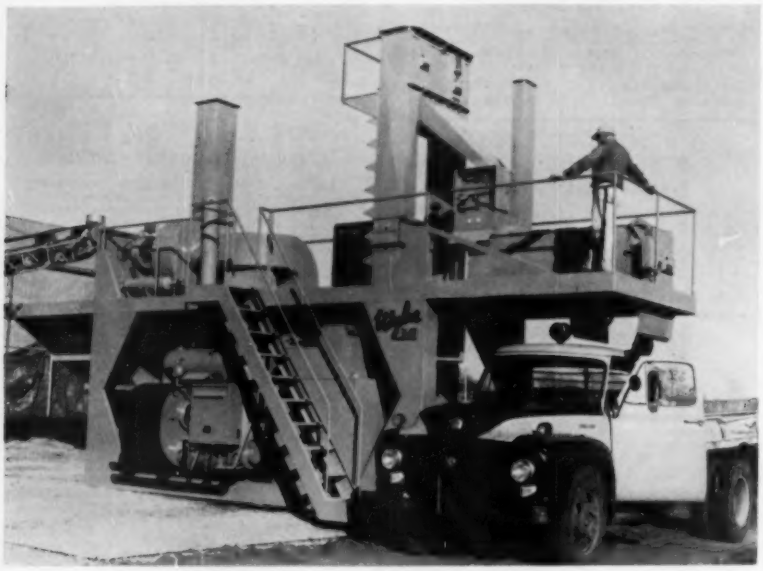


Asphalt Plant

The Wylie 3140 Roadmaster plant is a self-contained unit with an output of 30 to 40 tons of hot mix per hour and up to 50 tons of cold mix per hour. The plant is built to operate upon its own base, eliminating concrete piers. The unit is completely automatic and once the machine is set in operation, the operator is free to supervise from the operator's deck the charging of material hoppers and loading of trucks.

Its eight-foot overall width and the laydown features of the upper section of the elevator eliminate moving problems. All thermometers, gauges and control levers on this double-deck plant can be operated from the central control station. Because of automation, the quality of the mix is not dependent upon the skill of the operator.

The direct charging of aggregate from material hopper into the dryer eliminates a cold material elevator and possible clogging of chutes. To aid in adjustment and ease of cleaning, the dryer combustion chamber and burners pivot away from the end of the dryer, making the interior of the dryer, elevator boot and combustion chamber readily accessible. The plant comes complete with a rotary dryer, twin-shaft pugmill, batching hopper, material hopper, hot elevator, dust collector, power plant, natural gas or low pressure oil burner heating system, and a 200-gallon asphalt metering system, all mounted on one frame.

Wylie Manufacturing Company, Inc., P. O. Box 7086, Oklahoma City, Oklahoma.

Circle **No. 1-1** on the convenient reply card facing page 38.

Time Switch

A one-dial/three-circuit time switch, developed expressly for traffic signal controllers, the unit eliminates the danger of the wrong controller being energized (due to improper synchronization) when two or more time switches are used. Called the Model #8077 SK, it is ideal for the replacement of older and obsolete type units as well as for new installations. Old equipment need not be altered; the unit's mounting plates fit the standard mounting switch holes.

The full day's program is set but once on the one 24-hour dial, accurately, with the special tabs on the dial. As one circuit is switched "off" the next is instantly energized and the proper traffic controller dial placed in service. From 1 to 48 individual operations per day, in 15-minute increments, may be programmed with the tabs. The special tabs eliminate both the need to slide on-off tripper manually and, the danger of the trippers working loose from the dial.

A "skip" feature enables keeping either or both circuits 2 and 3 off on weekends or any selected days of the week. The 8077 SK is also available with Tork's 20-Hour Reserve Power, to insure continued operation in the event of power failures. When power is restored, traffic controls are back in "on time" operation without the need for dispatching service crews to reset.

Traffic Control Div., Tork Time Controls, Inc., Mount Vernon, New York.

Circle **No. 1-2** on the convenient reply card facing page 38.

Push Plate Plow

A combination front push plate and snow plow permits use of a service vehicle for two operations, snow plowing and pushing cars.

A front push plate, constructed of 5/16 in. steel, 14 in. wide and 40 in. long, is installed and reinforced to chassis with 14 in. brackets. The snow plow, anchored to bottom underside of plate with two, 1-in. pins, is electric hydraulic with dashboard control. Plows can be supplied for all vehicles and come in 6, 7 and 8-ft. lengths.

Weld Built Body Co., Brooklyn, N. Y.

Circle **No. 1-3** on the convenient reply card facing page 38.

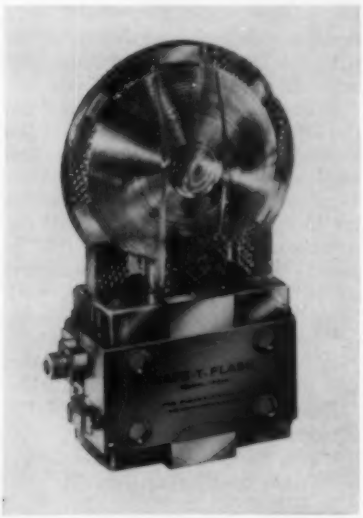
Safety Flasher

An efficient, transistorized highway safety light suitable for mounting in saw horses and barricades, the Safe-T-Flash produces precisely-timed flashes through a 7-inch amber colored plastic lens that is scientifically designed for maximum brilliance. It operates continuously at a choice of two flash rates and flash durations. Model 1751A produces 135 flashes per minute, 55 milliseconds duration; Model 1751B produces 67 flashes per minute, 110 milliseconds duration. Other rates are also available.

The lens and battery case of the flasher from a one-piece enclosure of amber-colored high-impact plastic that will not shatter or crack under normal use. Further protection from damage is provided by a corrosion-resistant steel housing with a heavy-duty catch. The unit is not affected by direct sunlight, rain, sleet, hail, snow or dust. The lamp and sealed-in transistor circuit are included in the shock- and vibration-resistant Flash Pak, which is easily attached to a 6-volt battery. Battery and lamp changes are easily made.

The Fisher-Pierce Co., 170 Pearl St., So. Braintree 85, Mass.

Circle **No. 1-4** on the convenient reply card facing page 38.



Submersible Pump

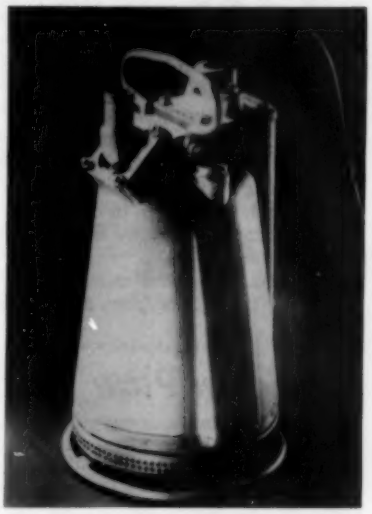
A 110-volt version of the Flygt 1½ in. model B 38F electric, submersible pump is equipped with 1.8-hp motor and features capacities to 85 gpm and heads to 90 feet. The 110-volt B-38F draws only 13 amperes, allowing it to be operated from most house currents and small portable light plants and generators.

The light-weight pump is easily carried by one man. It's simple to install, needs no priming, can run dry continuously, pump water containing abrasives and a high degree of solids, and requires no lubrication.

Besides this 110-volt version, these 1½-in. Flygt electric, submersible pumps are also available in 220-volt, single-phase and 220/440-volt three-phase models.

Stanco Mfgs. & Sales, Inc., 1666 Ninth St., Santa Monica, Calif.

Circle **No. 1-5** on the convenient reply card facing page 38.



Post Auger

Cutting-tooth principles have been incorporated into the design of the PosterBore auger designed primarily for use in the construction of pole anchors, highway guard rail posts and signs, and other fields. The auger digs and carries off in one operation with effectiveness and speed improved by strong penetrator points and teeth for graduated cutting action. More force is applied effectively at the cutting teeth insuring more depth per revolution and less drag.

Designed of high-strength cast steel, the functional lines of the brand-new auger eliminate multiple parts and the PosterBore's streamlined shape is designed with only 3 interlocked pieces. Heavy-duty steel jagged teeth promote biting on the first turn and eliminate wheel-spinning. This auger is quickly and easily assembled with the aid of a Spirol pin that locks the top of the penetrator and tooth assembly into rigid position. The pin is easily removed for rapid disassembly. Versatile in difficult ground conditions, the auger answers the demand for smaller-diameter augers and will eliminate problems involved in such installations as guard rail posts.

Trainer Associates, Inc., New Castle, Delaware.

Circle **No. 1-6** on the convenient reply card facing page 38.

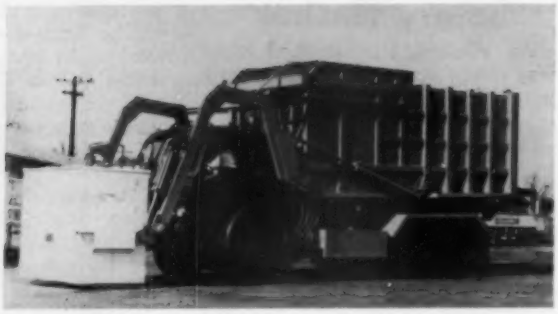
Airless Spray

High-Spray, a line of airless spray equipment offers 10 different models, portable and stationary, for handling all types of paints, including water base. The unique feature of the portable models is a self-contained locking device which immobilizes both wheel roll and caster swing. This enables the equipment to be used on inclined as well as flat surfaces.

The double action pump and exceptionally high fluid pressure at the nozzle (1650 lbs. from 75 psi air pressure) makes possible the use of two guns from each pump.

"Hi-Spray" Div., Balcrank Inc., 10 Disney St., Cincinnati 9, Ohio.

Circle **No. 1-7** on the convenient reply card facing page 38.



Slurry Machine

A slurry machine that makes possible the mixing and immediate application of slurry seals of fine aggregate, emulsified asphalt and water, the Young Slurry Machine, which may be mounted on any 2 or 2½ ton short wheelbase truck chassis, is easily operated by one man and a driver. It is a complete unit with balanced storage for emulsified asphalt, water and aggregates in separate compartments. A front-end loader can be used to charge it with aggregate. There is no need to measure any of the three items.

Provision is made for volumetric calibration of materials fed into a mixer located beneath and to the rear of the storage compartments. A unique screw type agitator in the mixer is built with a change of pitch at a point approximately one-third from the front end. This causes the material in the mixer to be churned toward the middle from both ends of the unit insuring thorough mixing. Only 1½ to 2 minutes are required for thorough mixing.

In operation the aggregate is delivered to the mixer by a belt feeder which has an adjustable gate. A metering pump, locked in ratio with the belt feeder, injects the emulsion allowing the operator to set the amount of asphalt content in the mixer. The emulsion is fed into the mixer at the point where the two opposing forces of motion come together, while the water is fed in with aggregate in the front 18 in. of the mixer. This insures that the emulsion does not contact dry material. The water volume is variable and easily controlled by the operator with a conveniently located valve. Constant water pressure also feeds a spray bar that lays a fine spray of water on the surface to be sealed immediately in front of the spreader.

The outer spiral of the agitator forces the mixed slurry to the rear of the mixer where it is allowed to spill out of an adjustable gate. The mix falls into the spreader located beneath the mixer and is distributed evenly over an 8-ft. width by a squeegee equipped screed that is adjustable in height. Screeds larger than 8-ft. wide are available.

The unit can easily lay 2,000 sq. yds. per load and a single machine will cover 4,000 sq. yds. in one hour.

The Young Co., P. O. Box 2369, Waco, Texas.

Circle **No. 1-8** on the convenient reply card facing page 38.

Snow Plow

A big fast-moving snow plow that does not require extra casting wings, the plow is especially designed for use on the Cat 966 Traxcavator. The Balderson BV966 has easy-pushing moldboards, with a smooth conically-formed curvature.

An additional feature of the BV966 plow is its easy attachment in place of the Traxcavator bucket. This makes the Traxcavator an ideal snow-removal machine which can be used to open streets and highways as a snow plow, in addition to and prior to its standard use as a loader in removal of snow by trucks.

The BV966 is built to give years of service through the use of replaceable cutting edges and nosepiece, and adjustable shoes.

Balderson Inc., Wamego, Kansas.

Circle **No. 1-9** on the convenient reply card facing page 38.

Material Handler

A refuse container handling unit for use with the Dempster-Dinosaur, the "Dinomaster," gives the Dinosaur versatility for both heavy materials handling and general refuse collection and disposal.

The development, which consists of a compaction body and two cab-clearance lifting arms mounted on a standard Dinosaur frame, can be operated as a self-loading packer when automatically pulled up on the Dinosaur skid frame and locked in place.

It approaches a refuse storage container, engages the side channels, lifts it over the cab and empties the contents into its compaction body, where the material is squeezed to a fraction of its former volume by action of the 60,000-pound thrust of the packer plate. Containers used are the standard type design of use with the Dumpmaster, ranging from one-half through eight cu. yds.

It can easily be disengaged from the Dinosaur chassis and put on the ground at a central location and used as a transfer station for conventional packer trucks. Through its tilting frame hydraulic pick-up principle, the Dinosaur is able to handle a wide variety of containers up to 40 cu. yds. and larger, with loads limited only by the capacity of the truck and highway restrictions. Off-road models with capacities up to 80,000 lbs. are available.

Dempster Brothers, Dept. DN-196, Knoxville, Tennessee.

Circle **No. 1-10** on the convenient reply card facing page 38.

Multiple Luminaire

The Revere Quad-Oval is an efficient, inexpensive, multiple luminaire for area lighting of parking lots and malls. Its reflector and glassware combination provide high-intensity, glare-free illumination with the maximum utilization of light. Its light distribution pat-

tern approximates a square shape.

The Quad-Oval is offered in two models—each using four mercury lamps. The No. 5452 is furnished with four No. 2284 Endovals, using 400-watt mercury lamps. The No. 5453 is furnished with four No. 2502-B250 Urbanovals that will accommodate 100, 175 or 250-watt mercury lamps.

The pole-top adapter for each unit is a sturdy aluminum alloy casting that slips 3-inch pipe (3½-inch O.D.) and is securely held with four cuppointed combination set and leveling screws. A removable cover is provided on top for ease of wiring.

Revere Electric Mfg. Co., 7420 Lehigh Ave., Chicago 48, Ill.

Circle **No. 1-11** on the convenient reply card facing page 38.

Zetameter

The Zetameter is used for measuring the potential of colloidal particles in liquids. Since there is now a practical method of measuring this electric charge, it is possible to treat the liquid with a control additive that will reduce the charge to almost zero, thereby permitting the colloids to coagulate and precipitate. Clarification of liquids can now be done to a degree never before possible.

The Zeta Potential, determined by electrophoretic mobility, is a measure of the excess or deficiency of electrons attached to the surface of all particulate matter. The magnitude of the charges determine whether colloidally-sized particles in suspension will repel one another and thus remain suspended, or whether they will agglomerate and after a build-up in size, precipitate. This principle applies to particles from ultra-microscopic size to those sufficiently large to be visible to the

unaided eye. In order to agglomerate efficiently these particles so that they will settle, or so that they can be settled with the aid of a coagulating agent, it is necessary to reduce the Zeta Potential to the vicinity of zero. At this point maximum effectiveness of flocculating agents can be achieved.

The Zetameter comprises a minimum, though specific, amount of laboratory equipment needed to determine electrophoretic mobility and the Zeta Potential. This basic equipment enables a determination of electrical (specific) conductance which is the best and simplest method of quickly ascertaining changes in raw water characteristics.

Komline-Sanderson Engineering Corp., Peapack, New Jersey.

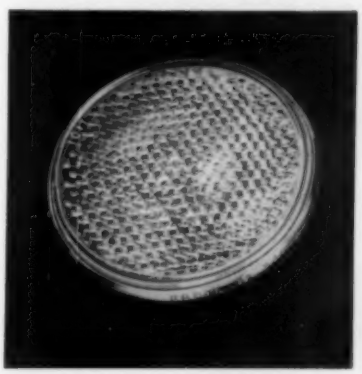
Circle **No. 1-12** on the convenient reply card facing page 38.

Highway Delineator

Designated as the Grote No. 12 Highway Delineator, this reflector features a sealed, waterproof lens. It meets the specifications and has been approved by state highway departments. The delineator mounts with a single bolt...either as a single unit or back to back. The lens then snaps into place. It is available in clear, red, amber or any standard reflector color.

Grote Manufacturing Co., P. O. Box 766, Madison, Ind.

Circle **No. 1-13** on the convenient reply card facing page 38.



Paydozer

The first model of the Paydozer, D-120, is powered by a 300 hp. turbo-charged diesel engine and weighs 55,000 pounds. The three-way blade action includes lifting and lowering, forward and backward pitch as well as side tilt. A unique feature of the D-120 dozer is the fact that it can be converted into a front-end loader whenever new projects or different working conditions dictate need for loader rather than dozer units.

The optional package which permits this conversion includes boom arms, hydraulic lines, bucket and linkage together with one element of the torque-converter for loader operation. The entire change can be made in less than two, eight-hour working days.

Features of the basic D-120 unit include full-power-shift transmis-

sion which requires no stopping for range shift. It is a full-reversing, constant-mesh type transmission with four speed ranges (up to 26 mph) in both forward and reverse.

The matching torque-converter is a single-stage, single-phase unit delivering maximum torque for exceptional traction for dozing and push-loading operation. The hyraulic power-boosted steering assist makes handling of the big D-120 almost effortless.

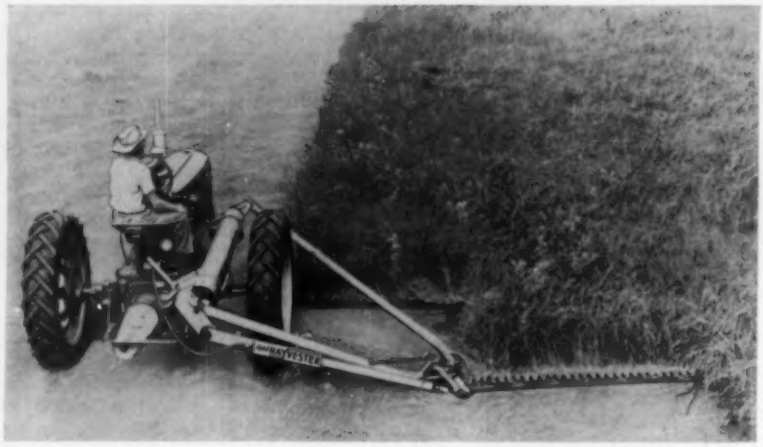
Dual foot-brake pedals are provided with one disengaging the transmission while braking and the other braking with transmission engaged. Power-transfer differentials on both axles provide the best possible traction; when one wheel is capable of more tractive effort than the other on the same axle, it can automatically receive 38 percent more torque.

The D-120 blade is 12-ft., 4-in. wide at the cutting edge and 4-ft., 8-in. high. Clearance under the cutting edge, at full lift height, is 3 ft., 2 in.

The Frank G. Hough Co., 761 Seventh Ave., Libertyville, Ill.

Circle **No. 1-14** on the convenient reply card facing page 38.

Cutter Bar



To help reduce roadside maintenance costs the 9-ft. cutter bar is practical for most mowing conditions along roadsides and rights-of-way. Especially recommended for broad sloping shoulders and wide areas along many of today's highways, the cutter bar is side-mounted ahead of the rear tractor wheel where the operator can see where he's going and what he's mowing. For more restricted mowing conditions where shoulders are narrow and roadside terrain is rough and uneven, the Kosch Standard Side-Mounted Mower is available in widths of 5 ft., 6 ft., and 7 ft.

For mowing along roadsides of the new toll roads and interstate highways, the Kosch Hay Vester is recommended. Compared to standard width mowers it cuts mowing time in half because it mows a swath of from 12 ft. to 16 ft. The Kosch Hay Vester features two mowers, mounted in tandem on the tractor accomplishing adequate maneuverability and ease of operation. The first unit is the standard 7-ft. side mount. The extended rear mount has the flexibility of utilizing a 5, 6, 7 or 9-ft. cutter bar so the total swath cutting capacity can be increased up to 16 ft.

Kosch Manufacturing Co., Columbus, Nebraska.

Circle **No. 1-15** on the convenient reply card facing page 38.

Mix Plant

A portable, stabilized base mix plant that includes pugmill, conveyor, bins, plus all piping and metering equipment, all mounted on wheels, the Universal portable Thoro-Mix has produced up to 500 tons per hour of material. The pugmill, either twin or single shaft,, is mounted at the end of a full 24-in. conveyor and at heights well above the truck dumping minimum.

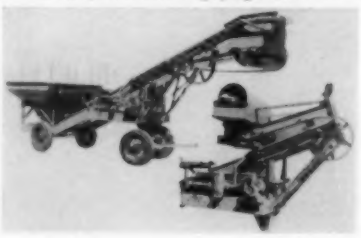
An accurate calibrated valve controls the metering of water to the spray bars. A measuring water meter is also supplied for positive control. All equipment, including a centrifugal type pump, is mounted on the portable frame at operator's waist level. A quick action lever type valve controls water feed and permits quick shut off to avoid wet or putty spots in the compaction.

Mixing is in a confined, self-lining tub with either twin or single shafts, depending on the requirements. Paddles on the shafts are removable and reversible. They can be reversed to retard movement of material through the tub, assuring more thorough agitation. Tips are replaceable when necessary. The pugmill folds back with the conveyor end for transportation and the entire unit has the same clearance as the bin.

Special injecting or metering equipment is available to be mounted ahead of the pugmill for measuring calcium chloride, cement or other additives when the specifications call for them.

Universal Engineering Corp., Cedar Rapids, Iowa.

Circle **No. 1-16** on the convenient reply card facing page 38.



Clamshell Attachment

The Parsons-Shawnee 88C Hydro-Clam is a backhoe attachment for utility tractors designed specifically for spot excavations. The Hydro-Clam is available with 24, 30 and 36-in. wide buckets, features 10,000-lb. breakout, 3,000-lb. lift capacity, 12-ft. digging depth, 9-ft. 9-in. dumping height.

The bowls operate independently or together to produce smooth, clean sides and level floor. Tremendous breakout pressure of clam bowls produces square corners. Entire clam assembly can be attached or detached for boom in minutes.

Parsons Co., Newton, Iowa.

Circle **No. 1-17** on the convenient reply card facing page 38.

Valve Actuator

This hydraulic valve actuator on which motor and pump run only for the few seconds required to open or close the valve, provides an automatic locking feature that holds gate or plug in any desired position almost indefinitely. Suitable for use on virtually any type or size of valve, the complete unit, including motor, pump and coupling, integral reservoir, pressure switch, and hand pump, gauges and any required safety devices, fits well within overall valve dimensions.

The automatic locking feature is controlled by an internally-mounted directional control valve. Oil-Dyne valve actuators can be set up for direct or remote control, permitting single location control of several valves located at different points. Actuators can be equipped with hand pump for use in event of power failure, or on applications where power supply is not available or may not be required.

Oil-Dyne, Inc., West Marquette Rd., Chicago 36, Ill.

Circle **No. 1-18** on the convenient reply card facing page 38.

Grader Blade

Snow and ice removal by motor graders and under-body truck graders with 6-inch blades which wear down rapidly poses a special blade change problem. A solution to this cold weather problem is a wider, thicker, longer wearing blade, the Pacal X-Tra Edge blade. It lasts longer during snow and ice removal and permits blade changes at times and places convenient to the users. It can be used as a conventional 2-piece arrangement, or as a 3-piece arrangement.

In the 3-piece arrangement the blade is center-mounted where wear is normally greatest. The hardened steel blade increases in thickness from ½-in. at the top to ¾-in. at the wearable portion and is 8 in. wide. When installed, the special center blade is flanked by two 8-in. end blades of ½-in. thickness.

In situations requiring exceptional down pressure per foot of blade, the two end blades may be removed and work accomplished using the center blade only. This permits the operator to keep his blade underneath ice or packed snow.

Paper, Calmenson and Company, St. Paul 13, Minn.

Circle **No. 1-19** on the convenient reply card facing page 38.

Traffic Marker

A flexible traffic marker available for traffic control on highways, plant sites, parking areas, and construction jobs is made with long-lasting "Hypalon" synthetic rubber. The brilliant yellow tubular traffic marker snaps back even if hit by a car at 60 miles per hour. The marker will retain lasting coloration, as well as toughness and resiliency under exposure to sun, weather, oils, grease, and ozone-charged atmospheres characteristic of heavily traveled highways.

The body of the marker is a 16-inch tube of the rugged elastomer, two and one-half inches in diameter, mounted on a metal disk base. The base is affixed firmly to the pavement with mastic or epoxy compounds. Tests have shown that both base and tube can be run over repeatedly by automobile and truck wheels without damage.

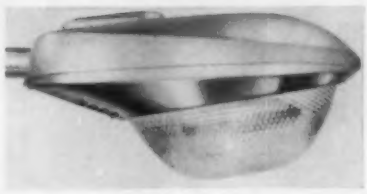
The ability of the markers to be dismounted and moved is a major advantage, permitting ready revision of traffic control plans without unnecessary expense. The base plates are inexpensive and can be left in position on the pavement without danger of damage to tires. In addition, temporary traffic measures on construction sites can be put into effect economically.

An alternative installation for use only on concrete pavement features a powder-driven anchoring stud to which the tube can be attached.

Nationwide Traffic Engineering Co., Inc., 2535 Mount Carmel Ave., Glenside, Pa.

Circle **No. 1-20** on the convenient reply card facing page 38.

Luminaire



The Joslyn "400" Built-In-Ballast mercury luminaire has successfully withstood wind velocities of 125 mph in actual wind tunnel tests. In addition, this compact unit utilizes a new concept of mounting components on a sturdy saddle attached directly to the pipe bracket. Attractive aluminum housing includes louvers and vent to insure cool operation of electrical components with 400-watt lamp. Can be installed with ease by one man.

Joslyn Mfg. and Supply Co., 155 No. Wacker Drive, Chicago, Ill.

Circle **No. 1-21** on the convenient reply card facing page 38.

Fleet Car

Larks are being operated by over-350 federal, state, county and municipal government subdivisions. Advantages for fleet operators include: Economy, which includes initial cost, operation, maintenance and a high resale value assured by consistency of design; exceptional maneuverability for today's congested streets and crowded highways; made for severe service and long life; interior dimensions above average for compacts; and wide choice of engine, transmission and axle-ratio combinations.

In addition to the regular line of body styles and an extensive selection of special fleet equipment, Studebaker offers special fleet cars built for specific purposes. New standard equipment on all models for 1961 includes bonded brake linings, safety-padded dash, suspended brake and clutch pedals, new fresh air inlet on cowl with improved circulation, counterbalanced hood mechanism, safety cone steering wheel and increased windshield wiper area.

A wide choice of optional equipment is offered for all fleet vehicles. Available are special thermostats, generators, alternators, six blade fans and fan shrouds and direct reading ammeters and oil pressure gages.

Studebaker-Packard Corporation, South Bend, Ind.

Circle **No. 1-22** on the convenient reply card facing page 38.

Compact Truck

A line of trucks and tractors functionally engineered for increased payloads and low cost operation and maintenance in today's heavily congested city traffic and terminal areas, the White Compacts can be turned in either direction with a wheel cut angle nearly one hundred percent greater than other similar units. While the tractor is designed for piggyback, yard shuttling and peddle runs as well as inter-city service, both the tractor and the truck are designed for metropolitan service.

Features include a short wheelbase (74″ to 96″) for the tractor and (114″ to 150″) for the truck, wide-track front axle (80″), high capacity steering and outboard-mounted front springs.

Light chassis weight on the rear axle, obtained by substantial weight transfer to the set-back front axle, permits a gross combination weight of 60,000 lbs. for the tractor while the truck version, with optional components to 28,000 lbs. gross vehicle weight can meet a wide range of vocational applications. An off-set fifth wheel which permits even greater transfer of weight to the front axle of the tractor is available as optional equipment.

Chassis frame is single channel of high tensile, low alloy steel for the tractor and truck. On long wheel bases and with the heavier rear axle, the same basic frame section is used but it is constructed of heat treated chrome-manganese steel. Chassis of both vehicles is of nut and bolt construction. Standard engine for the tractor is the White Super Mustang 6-145A and the 6-130A for the truck. Unit options for the tractor include the 6-170A and the 6-185A, while the 6-145A and the 6-170A are available in unit options on the truck.

The White Motor Co., 842 East 79th St., Cleveland 1, Ohio.

Circle **No. 1-23** on the convenient reply card facing page 38.

Tankless Distributor

This trailing tankless-type bituminous distributor is towed by the bituminous supply truck from which the distributor draws its material. It can be towed job-to-job at super-highway speeds. Originally designed to meet Army Corps of Engineers requirements the unit is ideal for all types of civilian applications. These include asphalt stabilizations and large sealcoating jobs. Because it can be kept working virtually non-stop, the new unit is an excellent running mate for the high-speed chip distributors now so popular for sealcoating. On long mileage jobs, remote from the source of supply, one tankless distributor can handle the material brought in by a fleet of tank trucks. Removal of spray bar, pump, engine, and controls from the tank truck also permits the hauler to carry a larger payload.

The full-circulating spray bar folds vertically and swings horizontally rearward for protection, should the bar strike an obstruction. Extensions can be added to increase spray bar length from its basic 12 ft. to 24 ft. Nozzles are 4 in. apart.

All functions of a modern bituminous distributor are accomplished by a new master-control valve, which greatly simplifies operation of the unit.

Seaman Corp., P. O. Box 3025, Milwaukee 18, Wisconsin.

Circle **No. 1-24** on the convenient reply card facing page 38.

Asphalt Finisher

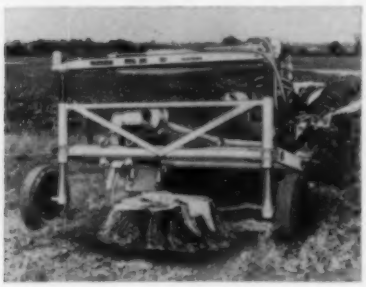
The SA-40 crawler-mounted asphalt finisher is designed to lay any sort of asphalt surface, in widths from 8 to 14 ft., at laying speeds of 100 ft. per minute. Among the engineering features of this design are: Hydraulically raised hopped sides, providing a self-cleaning receiving

hopper; oscillating pivoted truck contact roller, permitting the paver to push a mis-aligned truck without affecting the operator's directional control of the finisher; automatically controlled twin feeders with manual override controls; and feeder control "feelers" adjustable as to position in the screw chamber to compensate for various laying widths. Compaction before strikeoff is provided by an hydraulically driven tamper and an extra-heavy duty heated screed, all mounted on automatically leveling support arms. Dual control columns, one on each side of the operator's platform, provide fingertip steering ease.

Barber-Greene Company, 400 No. Highland Ave., Aurora, Ill.

Circle **No. 1-25** on the convenient reply card facing page 38.

Stump Cutter



The Model P-15 Pow-R-Stump Cutter, driven by a standard tractor's power-take-off drive shaft, is a powerful, one-man operated machine that cuts stumps to shreds in minutes, is safe and simple to operate. One man controls the entire cutting operation with three conveniently located levers. The Stump Cutter can handle any size stump up to 33 in. in height, and has a travel range of six feet from side to side and 33 in. forward and backward. It digs out the stump down to 15 in. below the surface of the ground and the remaining hole can be refilled with the dirt and chips.

Vermeer Manufacturing Co., Pella, Iowa.

Circle **No. 1-26** on the convenient reply card facing page 38.

NEWS OF ENGINEERS

F. F. TENTSCHERT has been appointed assistant to the vice-president of Engineers Incorporated, engineers and designers, Newark, N. J.

CLINTON B. F. BRILL, colonel AUS, retired, is now president of Brill Engineering Corp., 220 Church St., New York, consulting engineers for turnpikes, bridges, arterials and allied work.

METCALF & EDDY, consulting engineers of Boston, Mass., have been commended by the Secretary of the Army for outstanding performance as architects-engineers for the Ballistic Missile Early Warning Systems at Thule, Greenland, and Clear, Alaska. General Itschner, Chief of Engineers, USA, presented the commendation.

J. D. STRONG, Col., USA, Ret'd., has been appointed field representative of the National Society of Professional Engineers.

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Technological University at Delft
Netherlands Universities Foundation for International Co-operation, (N.U.F.F.I.C.) at the Hague.

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19 October 1961—12 September 1962. Three branches of study: 1. Tidal and coastal engineering; 2. Reclamation; 3. Rivers and navigation works.
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II. Second European Course in Sanitary Engineering:
October 1961—July 1962 (with the assistance of the Organization for European Economic Co-operation, and the World Health Organization); dealing with the struggle with water pollution in densely populated regions.
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For information on both courses, write to:
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27 Molenstraat
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INDEX OF ADVERTISEMENTS

Acker Drill Co., Inc. 114
Air Placement Equipment Co. 26
Alabama Pipe Co. 136
Allied Chemical Corporation 58
Allis-Chalmers ..... 12, 13 & 33
American Bitumuls & Asphalt Co. 115
American Bridge ..... 50 & 51
Div. of United States Steel
American Vitrified Products Co. 53
Amercoat Corporation 126
American-Marietta Company 6
Concrete Products Division
American Playground Device Co. 144
Aqua Survey & Instruments Co. 24
Armco Drainage & Metal Products 135
Asplundh Chipper Co. 54
Aurora Pump Division 145
The New York Air Brake Co.
Ayer-McCarel Clay Co., Inc. ..... 10 & 11

Badger Meter Mfg. Company ..... 19 to 22
Baughman Manufacturing Company 32
Bowerston Shale Co. ..... 10 & 11
Butler Manufacturing Company ..... 47 & 48

Cannelton Sewer Pipe Co. ..... 10 & 11
Case Company, J. I. 37
Cast Iron Pipe Research Assoc. ..... 8 & 9
Chemical Construction Corp. 61
Chicago Pump Co. 3
City Tank Corporation 109
Clark Equipment Company 113
Construction Machinery Division
Classified Ads 165
Columbia-Southern Chemicals Corp. 106

Darley & Co., W. S. 116
Darling Valve & Mfg. Company 140
Dempster Brothers ..... 130 & 131
Dickey Clay Mfg. Co., W. S. ..... 10 & 11
Dratt Manufacturing Corp. 17

Eddy Valve Company 133
Enterprise Engine & Machinery Co. 39
Euclid 111
Div. of General Motors Corp.

Fairbanks Morse & Company 149
Fisher Research Lab., Inc. 46
Fitchburg Engineering Corp. 110
Flexible, Inc. 124
Ford Motor Company ..... 14, 15 & 62
Forneys Inc. 128

Foster Company, L. B. 18
Foxboro Company 143

Gorman-Rupp Company 43

Hamilton Kent Mfg. Co. 25
Hersey-Sparling Meter Co. ..... 28 & 35
Hotel Pittsburgher 49
Hough Company, Frank G. ..... 120 & 121

Ingersoll-Rand 4
International Harvester Co. ..... 17, 44 & 45
Irving Subway Grating Co., Inc. 36

Jacobson Manufacturing Co. 56
Jaeger Machine Co. 129
Jeffrey Mfg. Co. 125

Komline-Sanderson Engr., Corp. 141

LeTourneau-Westinghouse Co. 59
Link-Belt Company 55
Lock Joint Pipe Co. 52

M-B Corporation 114
M & H Valve & Fittings Co. 134
Massaglia Hotels 116
McConnaughay Mixers, Inc. 18
Momar Industries 150
Morse Boulger Inc. 108
Mueller Co. ..... 31 & Third Cover

Natco Corp. ..... 10 & 11
National Power Rodding Corp. 63
Neenah Foundry Company 42
Nichols Engineering & Research Corp. 151

Oliver Corporation 29
Ottawa Strato-Tower Equip. Div. 41
Young Spring & Wire Corp.

Pacific Flush Tank Co. 123
Pfaff & Kendall ..... Cover II
Pipe Linings, Inc. 22
Pomona Terra-Cotta Co. ..... 10 & 11
Portland Cement Association 68
Public Works 60

Reed Manufacturing Company 129
Roberts Filter Mfg. Co. 150
Rynal Corporation 38

Smith & Company, Inc., Gordon 137
Soiscor 168
Smith & Loveless 127
Solvay Process Division 58
Allied Chemical Corp.
Sprague & Henwood, Inc. 144
Steiert & Sons, Inc. 108
Studebaker-Packard Corp. 27
Synchro-Start Products Inc. 34

Tarrant Manufacturing Co. 46
Tennessee Corporation 49
Texas Vitrified Pipe Co. ..... 10 & 11
Trickling Filter Floor Institute ..... 10 & 11
Trojan Mfg. Co. 38
Troy Blanket Mills 57

United States Concrete Pipe Company 23
United States Steel Corp. ..... 50 & 51

Valley Manufacturing Co. 49

Vermeer Manufacturing Company 117
Visi-Meter, Inc. 24

Wallace & Tiernan Co., Inc. ..... Back Cover
Wausau Iron Works 34
Werley Chemical & Supply Co. 148
Westinghouse Electric Corp. ..... 64 to 67
Weston Co., L. A. 144
Wilkinson Products Company 116
Woodward Iron Company 16

Young Spring & Wire Corp. 41

CONSULTING ENGINEERS APPEAR ON PAGES 152 to 157

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Lowering 16 ft. length of concrete water main pipe weighing 40,000 lbs. into Milwaukee trench, using a Travelift made by Travelift & Engineering Inc., Sturgeon Bay, Wis.

Spinning 10,952 galvanized wire strands into one of the 23-inch cables for Throgs Neck Bridge, N. Y.

Part of 500 round ALCOA aluminum lighting standards, Penn-Lincoln Parkway, Pittsburgh.

The girls fortunately remain the same but pier designs change. An all-steel pier made by Standard Steel Products Mfg. Co., Milwaukee, is shown.

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by Arthur K. Akers

★ A Happy New Year to all of you, and a more prosperous one than ever!

★ Chicago Pump appoints **Leonard (Lee) Nechine** assistant manager.

Mr. Nechine

Mr. Searight

★ **C. E. Searight,** recently vice-president, has been elected president of Cataphote Corporation, continuing to headquarter at their Jackson, Miss., offices.

★ Earth Equipment Corp., Los Angeles, appoints **Bob Prescott** Western Regional Representative for their trenchers, dozers and back-hoe buckets.

★ **Steve G. Sutton** becomes manager of public relations, The Jeffrey Mfg. Co., Columbus, Ohio, succeeding **L. H. McReynolds,** for 40 years with the company. "Mac" will still base himself at Columbus but now roam more widely than an active advertising manager could contrive.

★ **Laurence Witten** is named advertising manager of Clinton Engines Corp., headquartering at the New York executive offices.

★ **George E. Gunther** is appointed domestic sales manager, Yale & Towne's Trojan tractor shovel line, at Batavia, N. Y.

★ Hersey-Sparling Meter Co. announces **Walter O. Weight** as Pacific manager for Hersey Products. **Mark H. Barnes** has been promoted to manager of the San Francisco branch for the same company and products.

★ **Roy R. Bush** has been promoted to sales vice-president, Rockwell Mfg. Company's Meter and Valve Division. He will remove to Pittsburgh from Tulsa.

★ General Electric Company's Communications Products Department, at Lynchburg, Va., appoints **Raymond Minichiello** manager of mobile communications product planning.

★ Lone Star Steel Co., Dallas, transfers **A. P. (Phil) Clarke** to the standard pipe sales department. This ties in with Lone Star's entry into manufacture of black and galvanized standard pipe.

★ Josam Mfg. Co. promotes **Edward J. Dwyer** to Midwest Regional Manager, in addition to his duties as chief engineer.

★ Diamond Alkali Co., Cleveland, appoints **Stanley B. Honour** sales manager, International Division.

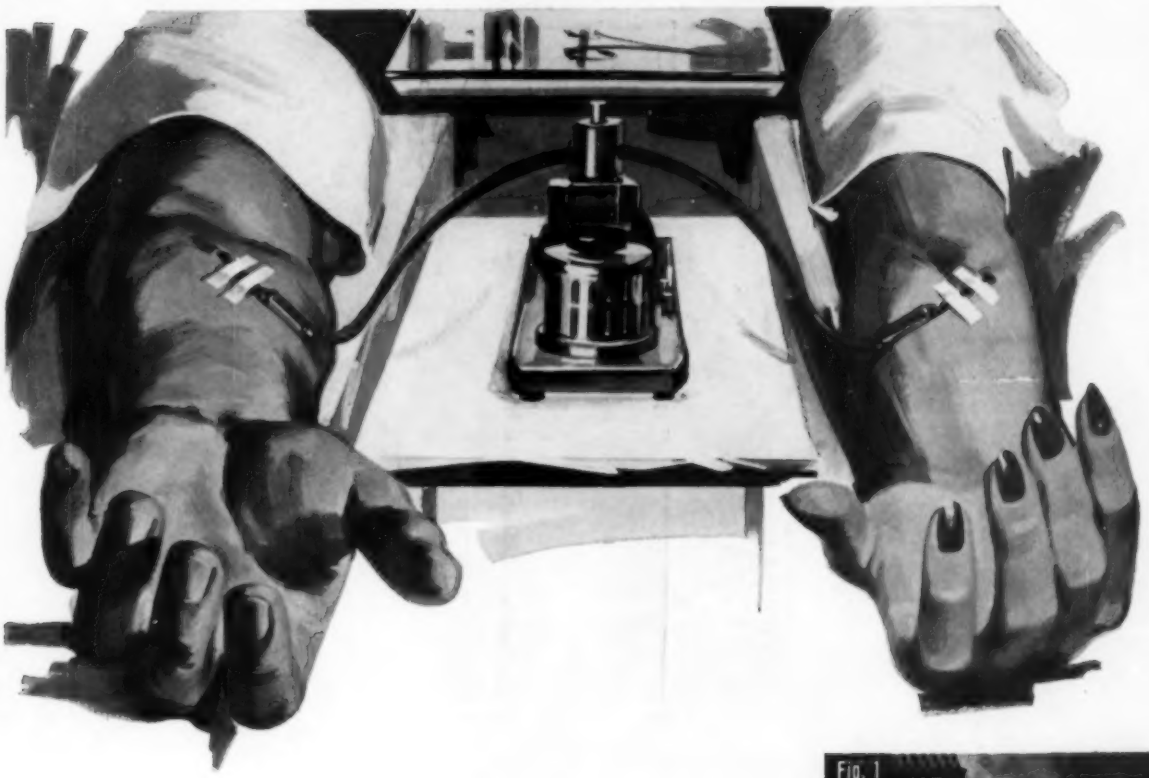
★ **Roger W. Ach,** former vice-president, sales, of Chester Products Inc., Hamilton, Ohio, manufacturers of aluminum swimming pools, has been appointed vice-president and general manager.

★ Sprague & Henwood Inc., Scranton, Pa. open a Southwestern Branch in Tucson, Ariz., under **Bill B. Williams'** management.

★ Allis-Chalmers Mfg. Co. will enlarge Plant No. 2 at York, Pa., by 36,000 square feet of production area.

★ **Russell C. Burns** succeeds **L. W. "Red" Pierson** as manager motor truck sales, International Harvester Co., Chicago. Pierson, on leave of absence, due to illness, will assume a new assignment on his return.

★ Young wife: "I wish to complain about your service."
Postmaster: "What's the trouble, lady?"
Young wife: "My husband is in New York on business and this card he sent me is post-marked Miami."



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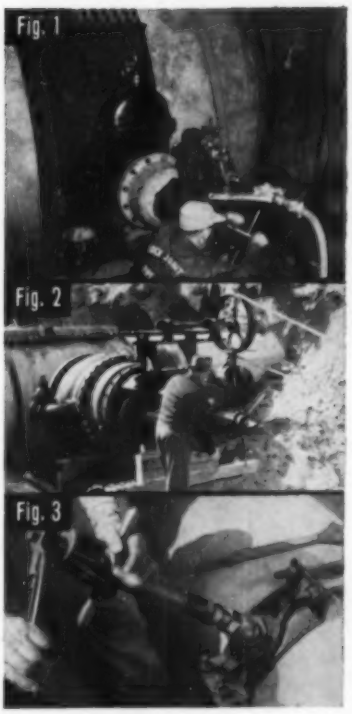

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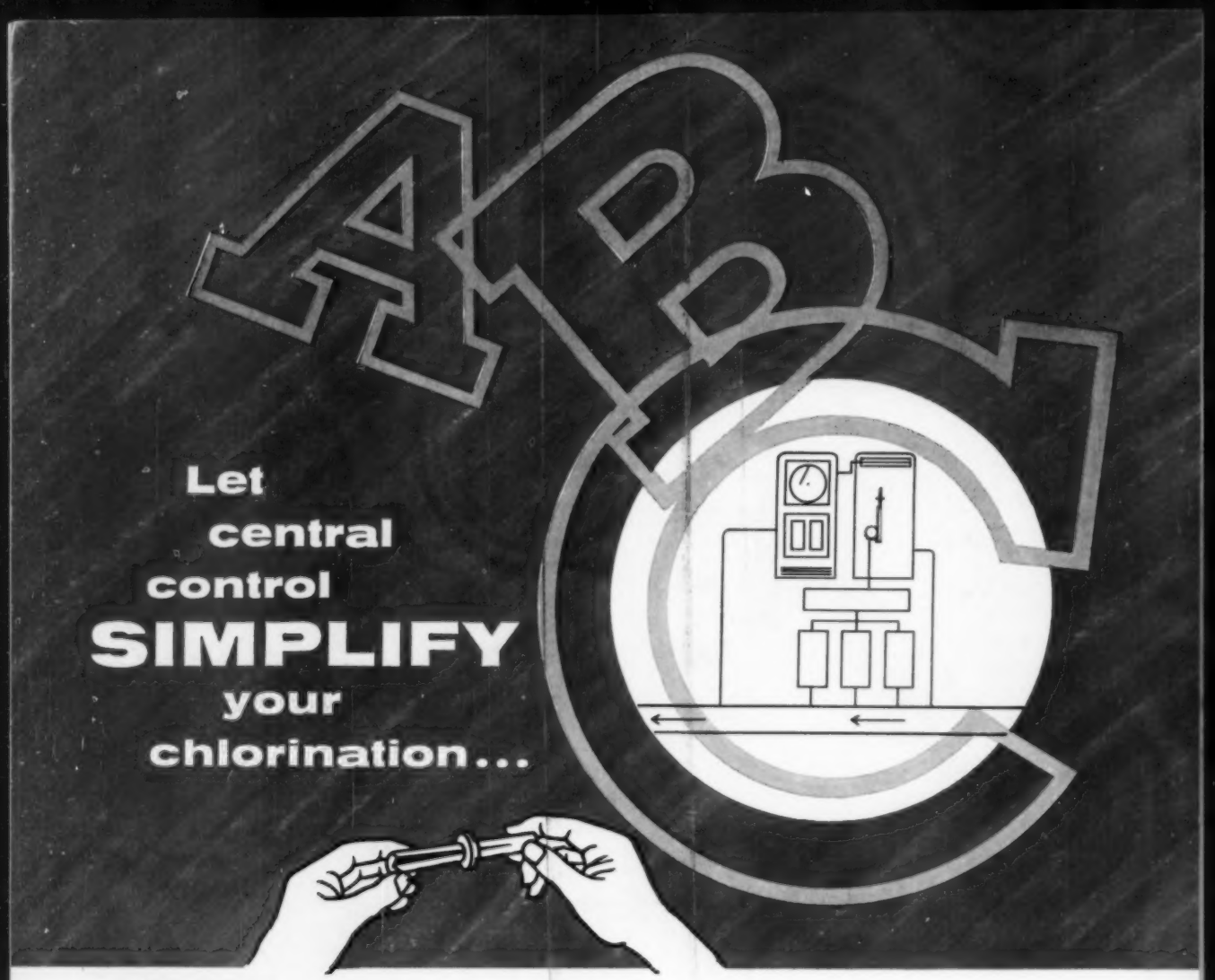

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